THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LIX. No. 1511.] LONDON, APRIL 26, 1892. [44TH YEAR. PRICE 6d.

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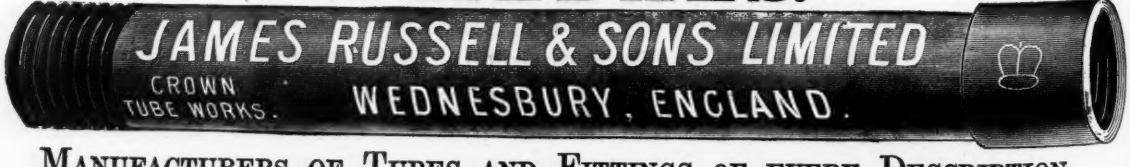

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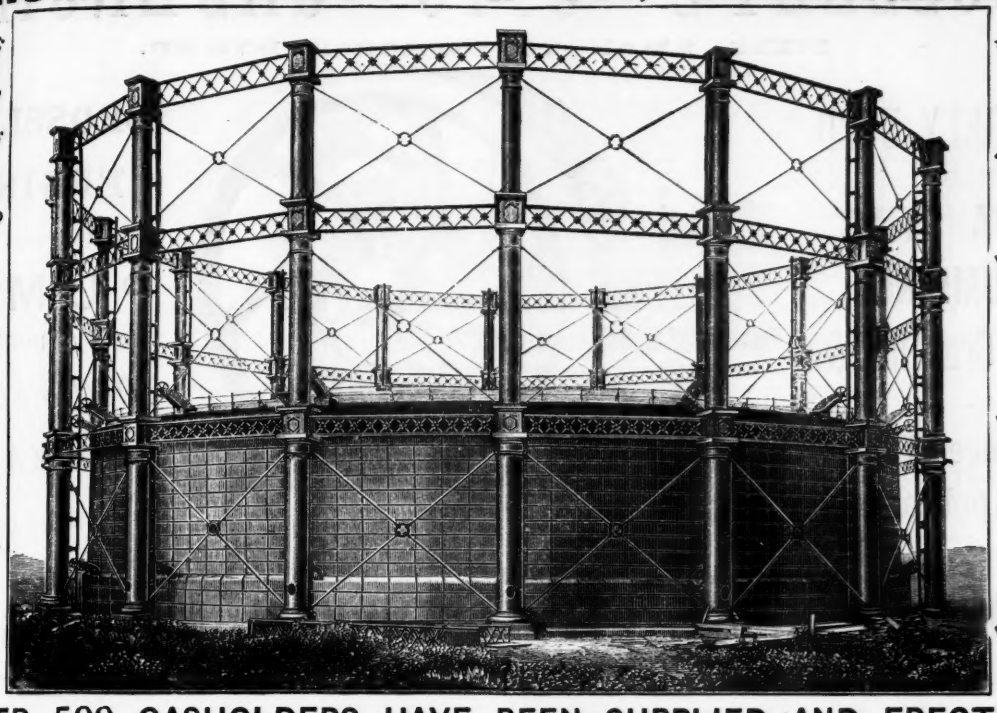

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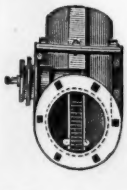

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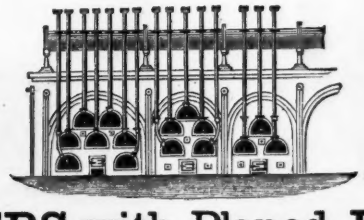

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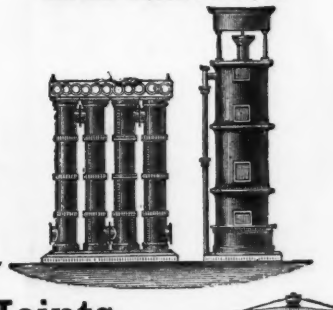

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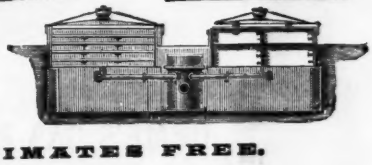

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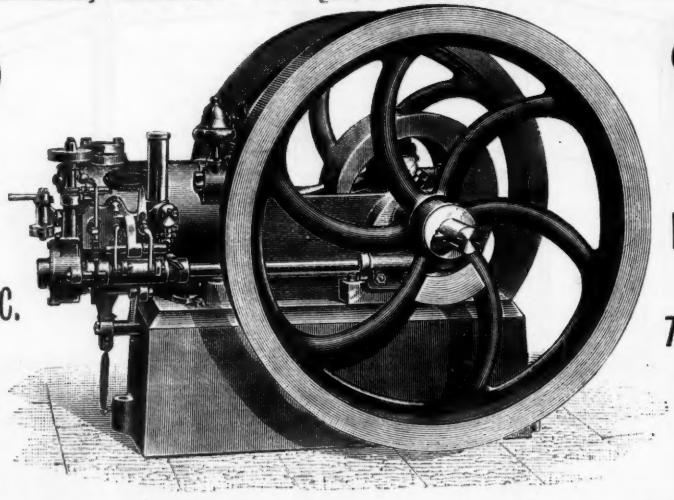

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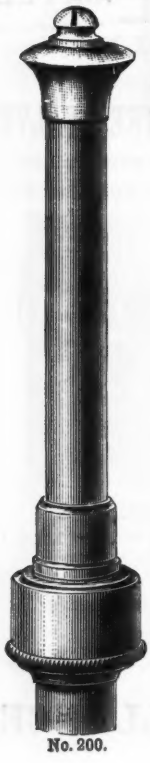

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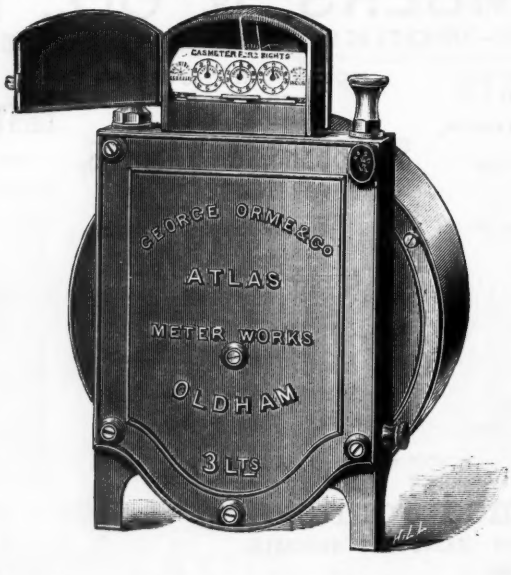

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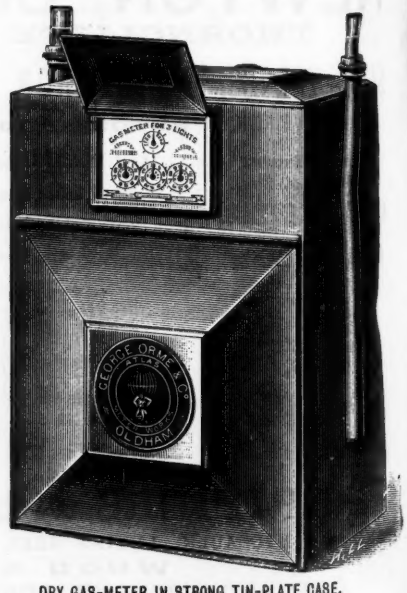

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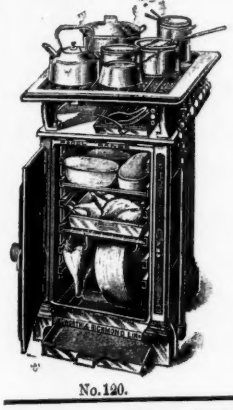

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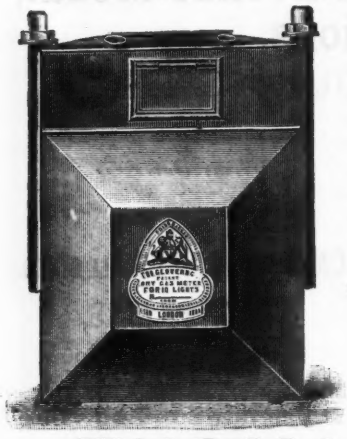

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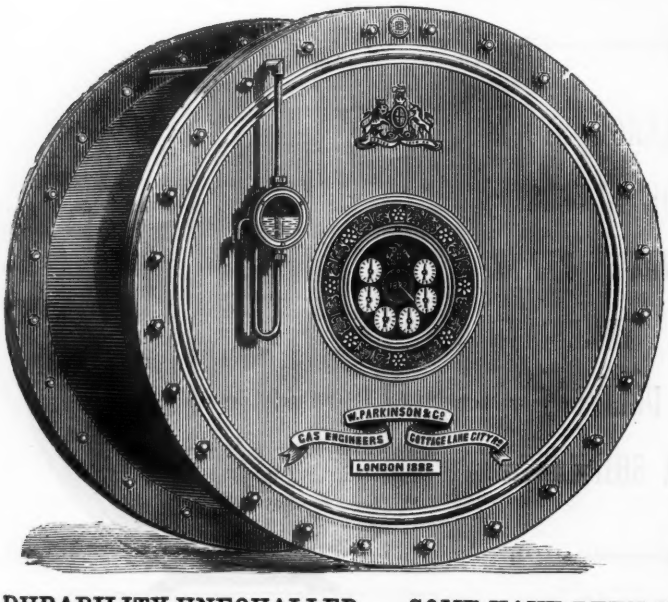

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CONTENTS.

EDITORIAL NOTES:—

GAS, LIGHTING, &c.— PAGE

The Centenary of Gas Lighting . . . 741
The Assessment of the Birmingham Corporation Gas-Mains . . . 742
An Informal Gas Managers' Meeting . . . 742
A Common Form of Robbery . . . 742

WATER AND SANITARY AFFAIRS—

The Work and Value of the Metropolitan Water Companies . . . 743
Dr. Frankland's Annual Report on the Metropolitan Water Supply . . . 743

ESSAYS, COMMENTARIES, AND REVIEWS:—

Gas and Water Companies in the Stock Market . . . 744
Electric Lighting Memoranda . . . 744
An Ill-Advised Prosecution . . . 745

NOTES:—

The First Colour of Heated Iron . . . 746
A Thermo-Dynamic Photometer . . . 746
A New Tar Roofing . . . 746

COMMUNICATED ARTICLE:—

The Present Position of the Gas-Works Rating Question. By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S. . . . 747

TECHNICAL RECORD:—

South-West of England District Association of Gas Managers—The Half-Yearly Meeting in Bristol—
Visit to the Severn Tunnel . . . 748
Mr. E. C. Riley on the Development of Gas Lighting in Railway Trains 749
Mr. F. Clark on the Enrichment of Gas in Bulk by Means of Carburetters 751
Ellery's Seal-Regulator for Hydraulic Mains . . . 752

REGISTER OF PATENTS:—

Manufacture of Gas—Bourgoin, W., and Decorce, H. . . . 753
Banding on Leathers for Dry Gas Meters—Shears, R. . . . 753
Gas-Engines—Barclay, A. . . . 753
Extracting Tar and Ammonia from Gas—Lister, A. A. . . . 753
Indicating the Presence of Gaseous Compounds in Rooms, &c.—Egger, B. 754
Prepayment Gas-Meters—Cowan, W. . . . 754
Gas Motor Engines—Abel, C. D. (Gas Motoren Fabrik Deutz) . . . 755
Manufacture of Ammonia and Tar from Nitrogenous Organic Substances—Thompson, W. P. (Kuntze, Dr. P.) . . . 755
Gas-Engines—Leigh, H. H. (Forest, P. F., and Gallice, G.) . . . 755
Patent Notices . . . 755

CORRESPONDENCE:—

The Minimum Size of Water-Mains, and the Laying of Mains, Hydrants, &c., for the Protection of Property from Fire . . . 756

PARLIAMENTARY INTELLIGENCE:—

House of Commons Committee—Birmingham Water Bill . . . 757

LEGAL INTELLIGENCE:—

Supreme Court of Judicature—Court of Appeal—The Attorney-General (on the Relation of the Local Boards of Chadderton, Royton, Crompton, and Failsworth) *v.* Mayor, &c., of Oldham . . . 759
Staffordshire Quarter Sessions—The Assessment of the Birmingham Corporation Gas-Mains . . . 759

MISCELLANEOUS:—

Gas Supply in the Colonies . . . 761
Boston (U.S.A.) Gas Supply—An Official Inquiry into the Boston Gas Company's Affairs . . . 761
The North Bierley Gas Company and their Stokers . . . 763
Electric Lighting for Worcester . . . 763
Metropolis Water Supply—The Quality of the Water in March . . . 764
The Glamorgan County Council and the Birmingham Water Bill . . . 764
Plymouth Corporation Water Supply . . . 764
Notes from Scotland . . . 765
Current Sales of Gas Products . . . 766
Coal Trade Reports . . . 766
Gas and Water Companies' Stock and Share List . . . 767

PARAGRAPHS.—Mr. J. S. Naylor, 743—The Gas Supply of Paris and Brussels, 743—The Experiments in Enriching Gas with Oil at Peterhead, 744—The Metropolitan Water Supply Commission, 744—The Proposed Gas Pavilion at the Chicago Exhibition, 746—Death of Dr. Tripe, 747—Coal in Suffolk, 752—The Use of Gas for Lighthouse Illumination, 752—Death of Ex-Bailie Wilson, 752—The Standards of Weight and Measure, 752—The Fourness Gas Process Syndicate, Limited, 756—Sale of Shares, 756—Water-Works for Millbrook, 756—Bombay Gas Company, Limited, 758—Electric Lighting for Oldham, 762—The Lighting of Rio de Janeiro, 763—Arundel Gas Company, 763—Preston and the Electric Light, 763—Anglo-Romano Gas Company, 763—Monte Video Water-Works Company, Limited, 763—Midland Railway Company and Electric Lighting, 764—The Todmorden Local Board and the Gas-Works, 764—The Rowley Regis Local Board and the Gas-Works, 764—Formby Gas Company, 764—Gateshead Town Council and the Water Company's Bill, 764—The Public Lighting of Bideford, 764—Belgrano Gas Supply, 766—City of St. Petersburg New Water-Works Company, Limited, 766—Sale of Shares in the West Ham Gas Company, 766—Sulphate Plant for the Newcastle Gas-Works, 766—New Water-Works for Northallerton, 766—The Castleton (Derbyshire) Water-Works Company, Limited, 767—Collapse of a Gasholder at Gillingham, 767—Stafford Corporation Gas Supply, 767—New Water-Works for Plympton, 767—The Reliability of Water-Meters, 767.

THE

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TUESDAY, APRIL 26, 1892.

The Centenary of Gas Lighting.

THE present season, just before the appointed times for the meetings of the representative gas institutions of England and Scotland, is a fitting opportunity for drawing the attention of readers of the JOURNAL to the interesting fact that this year is the centenary of the application of coal gas to the purpose of illumination, which was first done by William Murdoch, at his house in Cross Street, Redruth, in the year 1792. This circumstance was mentioned by Mr. T. D. Hall, of Montrose, in the course of his address at the recent informal meeting of Scottish gas managers in Glasgow. Mr. Hall (who, as he told his audience, was for some years Manager of the Redruth Gas-Works) at the same time exhibited to the meeting some photographs of Murdoch's house—one showing the memorial tablet affixed to the wall by Messrs. Tangye Bros., of Birmingham, which proclaims to the world the remarkable legend that from this humble abode two such world-changing inventions as steam locomotion and coal-gas lighting issued upon their momentous course. The Scottish gas managers, who claim Murdoch as a fellow-countryman, have acquitted themselves well in the matter of securing his formal admission into the ranks of their national worthies. Through the kindness of Messrs. R. Laidlaw and Son, a bust of Murdoch was exhibited at the Glasgow meeting; and, as already announced, arrangements will be made for placing the Murdoch memorial bust in the hall of the Wallace Monument at Stirling next July. We shall have to deal with this work of the Murdoch Memorial Committee (of which Mr. J. M'Gilchrist, of Dumbarton, is Secretary and Treasurer) at a future time, and shall therefore leave the subject for the present with an expression of congratulation upon the success which has so far rewarded their honourable labours.

The idea of celebrating centenaries and anniversaries of all sorts of events is being a little overdone in these times; and we are by no means inclined to ask our readers to attach any exaggerated importance to the one-hundredth year of gas lighting. All the same, the principle of publicly recognizing notable men and events at stated times is deeply rooted in human nature; and it would be as great a mistake to overlook such a period as the Murdoch Centenary as to overdo the celebration. From all that remains on record of his personality, we may safely conclude that Murdoch was a far more deserving man than many who, through favouring circumstances and a trick of self-advertisement, occupy a more conspicuous niche in the temple of Fame. It is, however, the glory of the British people that behind, and sometimes above and beyond, the notabilities whose names Fortune has blazoned with lustre eternally bright, so that they shine through the dusk of ages as beacons for their kind, there is an innumerable throng of worthies to whom the world owes more than it knows. Much that remains of Murdoch the man and the mechanician is told, with other appropriate matter, by his grandson, Alexander Murdoch, in a little book entitled "Light without a Wick: A Century of Gas Lighting," which, embellished with a photogravure of the memorial bust, is now being sold for the benefit of the Memorial Fund. The least that any gas manager or gas-works official, past, present, or prospective, can do is to procure a copy of this little work, for Murdoch's sake. One glance at the open, shrewd countenance, lighted up by a half-smile and a twinkling of the eye, will be enough to convince anyone that the ingenious Founder of one of the greatest of living industries was a good fellow, who would have taken pleasure in the thought that, although his partners in business did not think his application of gas for lighting worth patenting, his name and deeds would be remembered with due honour a hundred years later.

How little does the wisest of us know of the things that shall come to pass! The application of coal gas to the purpose of lighting was never patented, any more than Murdoch's other invention of the steam locomotive; and what have these discoveries done for the world! For steam locomotion we will not speak; but for gas we will maintain that this first suggestion in the world's history of a means of general public and private lighting, has done more to further the immense progress of the last century in mental and moral, as well as in mere physical enlightenment, than anything else that can be named in the same breath with it. We are not now speaking of Murdoch's own work, but of what came after Murdoch, who does not appear to have contemplated public lighting. It is easy to see now that a cheap, brilliant method of illumination applicable to large open spaces and capacious halls, and not needing to be trimmed, or calling for attention for any length of time when once set going, must have created a complete revolution in the social arrangements obtaining at the end of the last, and the commencement of the present century. Evening amusements and educational meetings hardly existed; the homes of the people were dingy and unlovely; and the police of the towns must have been inefficient, if the character of the force itself had been ever so good, in the absence of public lighting. Of course, the provision of good lighting did not create evening amusements and instruction, nor did it reform the forces charged with the duty of keeping the

peace; but it rendered possible and easy those wide-reaching reforms in these and other features of town life which have so distinguished our age from all that went before it. Gas has been more than sun and moon to modern times; and if, in traversing the streets at night, one should happen to entertain a passing emotion of wonder as to whether it is possible to believe, in despite of modern pessimism, that the world has gone forward somewhat as the result of the labours of all the good men and true who, like Murdoch, have lived and died since the dawn of the Era of Coal, Iron, and Steam—well, the feeling and the doubt should vanish at the sight of what the poet has styled "The century's chief adorner—The "flame of gas, in its frame of glass, Of the gas-lamp at "the corner!"

The Assessment of the Birmingham Corporation Gas-Mains.

THE literature of rating cases is being swollen by the record of the appeal of the Birmingham Corporation against the assessment of their gas property in the parish of Harborne, as fixed by the Assessment Committee of the King's Norton Union, to which the parish in question belongs. We give the report of the first part of these proceedings in another column. The matter stands adjourned to May 17; and this being so, we are precluded from discussing the merits of the case. As will be seen by our report, some of the same actors who played conspicuous parts in the recent Chartered assessment appeals —to wit, Mr. Henry E. Jones, the Chief Engineer of the Commercial Gas Company, and Mr. Danckwerts—have accepted this "starring" engagement in Staffordshire; and the way in which they opened their business was strongly reminiscent of the Clerkenwell performance. This is very obvious upon the face of the case. The Assessment Committee having raised the valuation of the mains in the parish of Harborne to £480 gross and £400 net from the rating agreed upon five years ago, which was taken at £270 net, the Corporation have set themselves to show that, instead of being raised, their assessment ought to have been rather reduced to about £200 net. This is precisely what the advisers of the Chartered Company did; and, so far as can be gathered from the evidence, the same advice is to be acted upon throughout the Birmingham case. There are, of course, some peculiarities of the latter which differentiate it from the former. Remarkably enough, the Birmingham Corporation happen to be charging the same price for gas now as when the last assessment was agreed upon; and it is not contested that their revenue has considerably increased. The appellants plead, however, that while their revenue has grown, their expenses have swollen disproportionately; so that their enlarged business is not worth so much, as a going concern, as it was formerly. It is quite refreshing to hear Counsel for the Birmingham Gas Department expatiate upon the plea that really the Corporation ought not to be treated as if they were a mere trading body, who kept the gas-works for profit. It is true, of course, that a profit is made, and that the outlying parishes supplied with gas by the public-spirited Corporation can see, in the various street and building improvements that have changed the face of Central Birmingham during the past twenty years, the fruit of the good prices they have had to pay for their light; but we are assured, on the authority of Mr. Danckwerts, that it would be quite a mistake to imagine that the Corporation regard their gas undertaking as a mere money-making concern. This part of the case is very funny reading; and one can but wonder whether the Corporation advocates and witnesses would pipe in the same key if it were a case of any parish desiring to buy its portion of the undertaking. These rating appeals are, however, peculiar things, as more than one legal luminary has confessed; and the invention of the "hypothetical tenant" is responsible for a good many other hypotheses operating to remove both evidence and pleadings from the region of sober facts to the realms of fancy.

An Informal Gas Managers' Meeting.

THE report which appeared in the last issue of the JOURNAL of the proceedings of the Scottish Gas Managers at their now annual "informal" meeting in Glasgow is of a character which reflects the highest credit upon all concerned. We should not be surprised to hear that the mouths of many gas managers in other parts of the kingdom had watered over this record of a most helpful, sociable, and enjoyable chat about "shop" in all its bearings. It is an old complaint of ours that District Associations of Gas Managers are apt to be far too formal. They are mostly over-staffed with officials who have little or nothing to do; and all their formality of constitution does not prevent the occasional collapse of a meeting. Taking into consideration the brief time of the whole year devoted to these gatherings, the share of it occupied by purely formal "business," to the perfunctory passing of resolutions, votes of thanks, &c., is to our thinking deplorable. What do gas managers enjoy most, when they meet their "brother chips" from whom they are severed for weeks and months on end, but the limitless talking of "shop"? This, followed by a modest dinner or meat tea, is a treat of a high order to the isolated gas manager; but it is what he does not get at many district meetings. Now, it is obvious that there is only one M'Gilchrist, upon whom the honour and the labour of getting up these "informal" meetings in memory of the West of Scotland Association falls so lightly; but surely England is not destitute of genial gentlemen who would be able to do as Mr. M'Gilchrist does, even at some little distance after him. The way he manages these friendly gatherings, without any organization, fuss, or expense, is a testimonial of considerable value to his talent in administration; and the popularity of the meetings clearly shows that they meet a distinct want. It would hardly be too much to say that in its "informal" immortality the West of Scotland Association is not less useful in death than it was in life. At all events, we trust that the Scottish gas managers will continue for many years to meet as they did on the 14th, and talk in the same interesting way upon the matters with which they and their professional colleagues everywhere are concerned in their every-day work. There is many a man who can give a useful hint in a few words which he could hardly expand into a paper; and these meetings are just the right place for such remarks. The "paper," indeed, great as is its utility, has certainly had the effect of banishing other less pretentious means of imparting information from the regular professional gatherings. This is to be regretted; and there is a corresponding amount of gratitude due to those who show, as the Scottish managers do once a year, that a supply of papers is not essential to the success of a gas engineering convention. We could wish that there were more of the same character.

A Common Form of Robbery.

NOT a day too soon, the editors of newspapers, periodicals, and the numerous and important class of scientific, technical, and trade journals which provide their readers with original matter, bought for the purpose, are raising a protest against the shameless way in which their best *and* most attractive articles are regularly stolen and reproduced by the conductors of other publications, of the scissors-and-paste kind, often with very insufficient acknowledgment, or none at all. Our esteemed contemporary the *Builder* began it; and, quite independently, a lively controversy upon the same subject broke out in the columns of the *Times*, over a theft of matter by one "religious" paper from another. Few technical publications suffer more in this way than the JOURNAL; and we are therefore glad to take this opportunity of assisting in the exposure of a practice of which the ever-increasing number of catch-penny periodicals is at once an effect and a cause. It can hardly have escaped the notice of any intelligent observer of railway bookstalls and newsvendors' shop-windows, that the space available for the display of newspapers and journals becomes more crowded every week with publications of infinite variety of title. A little closer examination reveals the, at first blush, amazing fact that highly specialized journals—organs of opinion and chronicles of facts and events appealing to different classes and divisions of the community—which were once rare and high priced, are now apparently both plentiful and cheap. Not merely every science, art, profession, trade, and calling has its one or two cheap weekly papers, but the followers of every fad or fancy that ripples the surface of social existence are catered for by journalistic bidders for custom. This would be harmless enough if it were only honest; but, unfortunately, with hardly a single exception, these "cheap" specialized publications are also "nasty." They are mostly made up of news cuttings from all sources, and their readable matter is all purloined

from respectable journals which pay their contributors. It is easy enough to produce a cheap paper dealing (say) with a branch of engineering, by the simple process of pasting together pell-mell all the newspaper clippings referring to the subject that can be raked together, headed with a few articles lifted bodily from better journals, and weighted with reported proceedings of technical societies, which are common property. American editors have long enjoyed a bad pre-eminence for this kind of piracy, which is perhaps to be explained by the callousness of the national conscience with regard to copyright in general literature. Some of our English newspaper people are, however, just as bad as any Yankee; and their offence is not diluted by the intervention of an ocean between robbers and robbed. For our part, we care little who takes our matter after it has once served its object in these pages; but it would be of some practical convenience, to say nothing of any consideration of common honesty, if those who borrow our choice bits would take the trouble to state where they obtained them. For lack of such a mark of origin, it not unfrequently happens that something which first appeared in the columns of the JOURNAL, and was promptly stolen and passed off as quite original in some other publication, is bandied about all over the globe; and, after many months (having meanwhile been translated into and out of several languages), arrives once more at the point whence it started. Several experiments have been made with a variety of animate and inanimate objects, with a view to ascertaining in how short a time the journey round the world may be made. We have seen the trip done by one of our paragraphs in from fifteen to eighteen months; and we are bound in fairness to admit that some of these have turned up quite fresh-looking at the end of the journey. Indeed, some bits of technical matter appear to be endowed with the troublesome immortality of the Wandering Jew, for they are always making their appearance in unexpected places. These, however, are usually the battered ones, whose misfortunes serve them for a disguise so complete that it requires a paternal eye to recognize them.

Mr. J. S. Naylor, Assistant Manager at the Cleckheaton Gas-Works, has been appointed Manager of the gas-works of the Selby Local Board of Health, in succession to Mr. W. H. Bell, resigned. He will enter upon his duties on the 4th prox.

The Gas Supply of Paris and Brussels.—Almost coincidently with the publication, in the last number of the JOURNAL, of the results of the working of the London Gas Companies in the past year, particulars came to hand of the gas supply of Paris and Brussels for the same period. Those referring to the former city were furnished by the report and accounts of the Paris Gas Company, which came before the shareholders at their meeting on the 29th ult.; the statistics as to Brussels being contained in the report presented by the Gas Committee of the Municipal Council to that body on the 11th inst. Taking Paris first, in the twelve months ending in December last, something like 11,000 million cubic feet of gas were sent from the Company's stations, as compared with 10,872 millions in 1890. The sale of this gas produced a revenue of £3,184,280—an increase of nearly £21,500 on the receipts in the preceding year. The accounts show a disposable sum of £1,016,000, half of which goes into the coffers of the Municipality, in addition to the tax of 2c. per cubic metre of gas, amounting to £215,892, and £8000 paid as rent for the use of the subsoil of the public streets. The shareholders received a dividend of 74frs. 50c., which, however, was a drop to the extent of 50c. on that for 1890, notwithstanding the augmented consumption. This is, of course, explained by the high price of coal and labour. The question of reducing the price of gas is still the subject of conferences between the Company and the Municipality; and though both parties profess to be desirous of coming to some understanding on the matter, a definite settlement seems to be still a long way off. The latest proposition is to lighten the Company's financial burdens by deferring the redemption of the bond capital until the end of the concession (Dec. 31, 1905), and leave to the City, who will then take over the concern, the responsibility of discharging the obligations still outstanding. Negotiations on this basis are proceeding. Turning to Brussels, we find that the consumption of gas in the past twelve months rose to nearly 752 million cubic feet, or about 50 millions in advance of that of the preceding year. Owing, however, to the reduction in the price from 3s. 4½d. to 3s. 1¾d. per 1000 cubic feet, and, as elsewhere, to the high price of coal and the depreciated value of coke, the result of the working was considerably lower than that of previous years. The Committee were only able to report a profit of about £32,000, against £55,830 in 1890—a falling off to the extent of £23,830. This is matter for regret, especially as the profits on the last-named year were less by £2264 than those for 1889.

WATER AND SANITARY AFFAIRS.

IN proof that municipalities do not in all cases manage the water supply so much better than a private company, Mr. F. G. Banbury a few days ago addressed a letter to *The Times*, showing that the water supplied daily for domestic use in Liverpool and Manchester, per head of the population, averaged less than half the quantity furnished to their customers for this purpose by the East London Company. Other municipalities were shown to be also giving a much more stinted allowance than that which is enjoyed in the Metropolis. The East London Company were stated to be providing a domestic supply at the rate of 28 gallons per head per day. But a gentleman residing at Queen Anne's Gate writes to *The Times*, challenging the figures relating to the Metropolis, and asking "has it ever been proved that the present sources "and filter-beds are sufficient to provide every day in the "year an amount equal to 28 gallons per head of the pre-"sent population?" We may observe that Mr. Banbury spoke for the East London district, and not for the whole area supplied by the eight Metropolitan Water Companies. For the entire area, the daily domestic supply last year would average a trifle less than 25 gallons per head. The difference is not essential, for the sceptical correspondent of *The Times* boldly declares his entire disbelief in the alleged magnitude of the Metropolitan supply. This is certainly a new phase of the controversy. Figures have been cited again and again to show that the Water Companies are shrinking the volume of the Thames, and are so depleting the Lea that it is a great wonder the river exists at all. If this new contention be correct, then the abstraction from the rivers is not equal to what has been alleged, and there is no cause for the outcry which has been raised. At the same time, it must be allowed that, if this is the case, there has been a lot of bungling on the part of those who have been gauging the stream and calculating the quantity abstracted. Perhaps these authorities will say a word in their own defence. General A. de Courcy Scott can also speak about the filter-beds. Another consideration is that, as the Metropolitan Water Companies have 185 pumping-engines at work—equal in all to more than 23,000-horse power, it must be presumed that an enormous volume of water is pumped up from the rivers and wells every day, or else that the engines must be intended for ornament rather than use. But we are glad to observe that this gentleman who has doubts as to the extent of the supply, has some reasonable notion with respect to the terms on which the Companies should be bought up. He proposes that for the space of 21 years after the undertakings have been transferred to the London County Council, the shareholders should receive from that body the same dividend as they had last year. After the close of the 21 years, the dividend is to be gradually reduced, until it becomes 2¾ per cent. It is suggested that a transfer on these terms should be at once settled by Act of Parliament; thereby bringing matters to a speedy termination. But what says the County Council? As affecting the value of the water undertakings, Colonel Makins has a letter in *The Times* of yesterday, in the course of which he shows the fallacy of Sir T. Farrer's contention, that the future liability of the Companies for the extension of their supply is to be taken as a factor in decreasing the present value of their property. In reply to this view of the case, Colonel Makins points out that the obligations of the Companies can extend only so far as the means granted by Parliament will allow. Further liabilities, or further chances of profit, can only attach to further grants of capital which may prove to be necessary, either for dealing with the present sources of supply, or others more remote.

Dr. Frankland's report on the Metropolitan Water Supply for the past year possesses features somewhat opposite in their character; rendering it necessary to give a careful perusal to the entire document in order to arrive at a correct conclusion. The operations of those Companies which supply river water are stated to have been seriously interfered with by dense smoke-bearing fogs in the early part of the year, and by heavy floods in the Thames and the Lea during summer and autumn. The storeage, subsidence, and filtration plant of the Companies who purvey river water is described as having been quite inadequate to deal with the exceptional pollution; "and water of "such bad quality, as regards organic matter in solution,

"has rarely been delivered by these Companies during "the last twenty years." This also signifies that the supply has been of superior quality during that period; thereby raising the standard of purity. But with regard to the actual organic admixture in last year's supply, the important fact is announced that there appears to have been "no abnormal amount of sewage contamination in the river "waters;" the great additional proportion of organic matter being due to vegetable sources. We also apprehend that the so-called "sewage contamination," minute in quantity, is merely of the "previous" character. A comparatively small proportion of organic material is found among the solid constituents of the water supply, and the real amount is "often quite insignificant." But a portion is made the ground of objection because of its "origin." It is said to come from sewage; and although it is sewage no longer, the argument is held that it may be accompanied by the germs of disease. Yet we are told by Dr. Frankland that such germs "have "never been observed in any water supplied to London," though it is suggested that they may have been there, only they escaped notice. Against such a possibility we may put one or two facts. In the first place, the filtered water supplied by the West Middlesex Company shows that 99·83 per cent. of the germs in the original water have been removed. The water which showed the least amount of purification last year was that of the Lambeth Company, where the reduction was 98·76 per cent. Thus the exclusion was, on the whole, nearly absolute; and concerning microbes in general we are told that "the vast majority "found in potable waters are, as far as is known, entirely "harmless." With regard to the state of the supply last year, the adverse circumstances already mentioned made it compare badly with the quality of the water in previous years. But both last year and the year before there was one thing in favour of the supply—the continuous increase of total combined nitrogen noticed in previous years having been checked. Last year the reduction was even to a lower point than in 1890. Dr. Frankland thinks it most likely that this was due to the increased rainfall, though he admits that it may have been brought about "by the more efficient exclusion of untreated sewage." In two instances during last year the water supplied was found to be "slightly turbid;" but, with these exceptions, all the samples taken were "clear and transparent" —a state of things which is described as a great improvement compared with the record some twenty years ago. Although Dr. Frankland still entertains sundry shadowy fears, it must be acknowledged that the facts tell very much in favour of the present supply.

The Experiments in Enriching Gas with Oil at Peterhead.—Our attention has been called by Mr. J. Mackay, of Peterhead, to the figures relating to the above experiments, given in our report last week of the remarks made by him at the meeting of gas managers in Glasgow on the 14th inst. He states that the durability of the coal gas with which he started was 41½ minutes, which he increased to 50 minutes by enriching with oil—not 4 minutes increased to 20 minutes, as given in our report; and that the percentage of benzol in the naphtha was reduced from 24 to 30 down to about 15, and not from 34 to 36 down to 15. Our reporter explains that his figures were in accordance with those on his notes, but that as Mr. Mackay, while giving them, stood with his back towards him, he might not have heard him distinctly. But he considered he had taken down the figures accurately; and so he did not ask Mr. Mackay to verify them.

The Metropolitan Water Supply Commission.—Yesterday the proceedings of the Royal Commission on the Metropolitan Water Supply were resumed at their offices, Trafalgar Buildings, Charing Cross. There were present Lord Balfour of Burleigh (Chairman), Sir G. B. Bruce, Sir Archibald Geikie, Professor Dewar, Mr. G. H. Hill, Mr. J. Mansergh, and the Secretary (Mr. F. Gaskell). The Commissioners had under further consideration several matters connected with procedure, and with the preparation of the maps and plans requisite for the inquiry. They hope that the preliminary statements for which the Water Companies and the principal public bodies concerned in the inquiry have been asked will be in their hands before the close of the present month. If this should be the case, the Commissioners intend to proceed without delay to hear evidence, and will probably call first on the representatives of the Water Companies. The Commissioners have resolved to admit to the sittings at which evidence will be taken members and officials of any public body interested, as well as any officer connected with a Water Company; and provision will also be made for the accommodation of a reasonable number of representatives of the Press. The Commission adjourned until Tuesday, the 3rd prox.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 767.)

THE Stock Markets have not yet returned to life again. They were dead enough before the holidays; and it was hoped that they might revive after the vacation was over. But as yet they have shown no signs of resuscitation; and the past week has been depressing to those who looked for a more stirring time. Prices have not uniformly fallen; but they are generally lower —there being no demand for anything. The Money Market shows no change from its easy condition. The Gas Market has been just as quiet as the rest; and though a fair number of changes are to be found in the quotations, they are none of them of any importance, and the chief issues are unaffected. Among Gaslights, the "A" was a little dealt in every day, opening unchanged; but from 213 marked on Tuesday, the figures were disposed to fall away, and on Saturday the closing bargain was done at 210½—the lowest of the week. The debenture and preference issues, however, were well supported—the demand for investment stocks being maintained; and they changed hands at satisfactory prices generally, while the "J" 10 per cents. rose 2. South Metropolitans have been but little touched; but the few transactions effected in them show continued firmness. In Commercials, the old stock thrown upon the market has had the result of still further depressing the price; the quotations falling another 1½. When this self-sacrificing operation is complete, the price may be expected to go back again. The new and debenture stocks remain firm. The Suburban and Provincial Companies have not developed any remarkable feature; and the only move is an advance of 1 in Brighton and Hove. Upon information received from the Secretary of the Company, we quote Tottenham and Edmonton "A" at a 5 per cent. price; but the Stock Exchange official quotation is not yet restored. Continentals are steady generally; but European £7 10s. paid was put down ½, without any business marked. Of the Indians, Bombay has gone up ¼ upon a satisfactory report and accounts, notwithstanding the state of the Exchange; but this factor has depressed Oriental to an equal extent. Among South American undertakings, Pará and San Paulo have fallen ⅛ each. The Water Companies are steadily recovering from the unwarrantable knockdown to which they were subjected; and most of them have advanced from 1 to 5 per cent. in the week.

The daily operations were: Gas opened unchanged on Tuesday, and so remained; business being quiet. In Water, Chelsea rose 2; and East London, 1. Wednesday's prices in Gas were mostly steady; but Commercial old receded 1½; and Pará, ½. The rise in Water was 3 in Kent and both Lambeth issues; 2 in Chelsea and Southwark; and 1 in Grand Junction. Thursday was, if anything, even quieter in the Gas Market. Gaslight "J" rose 2; but San Paulo fell ½. Southwark Water rose 1; but Lambeth 7½ per cents. were put down 2. The only feature in Gas on Friday was a rise of 1 in Brighton and Hove, and ¼ in Bombay; and a fall of ½ in European part paid, and ¼ in Oriental. Chelsea, Lambeth, and Southwark Water rose 1 each. Saturday was as quiet as usual; and the only change in quotation was a further rise of 1 in Southwark.

ELECTRIC LIGHTING MEMORANDA.

Another Awkward Breakdown—The Fortunes of the House-to-House Company—A "Corner" Defeated—When Critics Agree!

THE statement that another "accidental" extinction of the electric light in the Winter Palace of the Czar, this time attended with a small fire among the rafters of the roof, is one of those pieces of evidence of the incompatibility of theory and practice in electric lighting matters which we are peculiarly interested in placing upon record. A good deal of fun is often poked at the absurdity of the old-fashioned way of characterizing certain manufacturing processes, or systems of construction, as being "theoretically right, but practically wrong." One is occasionally asked by confident gentlemen fresh from a modern technical college, how anything can be properly so described. Well, the experience of the electricians is pretty full of illustrations of what is meant by this proverbial expression. From many a stall at the Crystal Palace Exhibition may be had pamphlets in which this or that system of electrical distribution is recommended as absolutely free from all risk of breakdown, of causing fire, or injury to life, or indeed from every imperfection. Yet, somehow, even in places where it might reasonably be supposed that every precaution would be taken to ensure the continuity of the service, these accidents constantly occur. In face of these mishaps, it is hardly to be wondered at that the general public continue to take the perfervid assertions of the electric light enthusiasts, professional and otherwise, with a good deal of "salt."

The House-to-House Electric Light Supply Company, Limited, have just held their annual general meeting; and, like all other companies of the kind, have had to rest content once more with a *succès d'estime*. The Chairman called the condition of the Company "comparatively satisfactory;" and when this is the best that can be said for an admittedly speculative venture, it is pretty safe to suppose that the standard of comparison, if

it could be known, would not be found a very high one. The Chairman had to confess that the rate of progress in the Company's actual lighting business had not been maintained last year as compared with 1890; and upon the same subject Mr. Robert Hammond, the Managing Director, assured the proprietors that the business would have increased much more "if the Company's plant had permitted the Engineers to take on more orders." Thus it appears to be the same old story of more capital being wanted long before that already sunk has proved remunerative; and the Directors of the House-to-House Company will need to keep a watchful eye upon the spending departments, if the expenditure is not to be allowed to swamp the concern. Mr. Hammond has hitherto had much more experience of spending capital upon, than of earning dividends by, electric lighting. While they do a little lighting, the House-to-House Company still keep their hand in with a little company-mongering; and there appear to be some Yorkshire ventures which owe allegiance and tribute to Mr. Hammond and his partners. This indeed appears to be the source of the only profit the parent Company can rely upon for paying their preference dividends. But the life of this concessionary kind of business, if merry while it lasts, is very short. How the Company are going to live out of the Kensington lighting alone is more than we can see at present.

A very pretty piece of Yankee "smartness" has come to light in regard to the supply of arc lamps for the Chicago Exhibition. The Exhibition authorities and the electricians have been very friendly since the commencement of this enterprise; and the former have even obliged the latter by turning a cold shoulder upon the gas lighting industry of the country, which is, to say the least of it, considerable enough to claim recognition by the Executive of a national industrial bazaar. Then it came to letting the contract for the arc lighting of the Exhibition, which, as at least 6000 lamps will be required, is a big thing. The authorities had talked the matter over with the representatives of the principal American electric lighting companies—the Edison and Thomson-Houston—and had been led to believe that the charge per lamp would not be more than from $15 to $20 for the season. However, before the tenders were to be opened, the various companies interested in the contract had amalgamated, and, as a consequence, only one tender was sent in, which came from the Thomson-Houston Company, chosen to represent the "ring," and this demanded $38½ per lamp. Such a barefaced attempt to "strike" the Exhibition was too much for the Executive, who appear to be acting honestly in the matter; and the tender was therefore peremptorily rejected. An intimation was also given that if the electricians persisted in their ill-advised policy, the lighting of the Exhibition might be handed over to European contractors. This and other representations of the same nature had a good effect; for it is now reported that the Thomson-Houston Company have "come down," and have agreed to furnish 2500 lamps at $20 each; the rest being divided among other contractors. This settlement is reported to give "general satisfaction." Very likely; the good people of the United States are satisfied with a very small display of commercial honesty on the part of their gigantic "trusts" and "syndicates." From an outside standpoint, however, the incident affords lamentable proof that the practice of the newest of all trades, in connection with a show that is supposed to testify to the unequalled advance of the United States in civilization, is vitiated in this year of grace by the same old chicanery that even the pilgrims of the *Mayflower* would hardly have looked upon as worthy of a respectable trader—except, of course, in dealings with the natives.

It is with sincere gratification that we find ourselves so commonly in accord, in our criticisms of matters electrical, with the best representatives of the electrical press. It is only natural that, as compared with their attitude respecting electric lighting topics, we should appear to assume that of the *Avocatus Diaboli*; but upon many points of criticism our unanimity is really astonishing. The *Electrical Review* and the *Electrician*—which latter organ, by the way, has greatly improved of late—entertain the same contempt of the quacks and mountebanks of the electrical profession as we do; and they always maintain, with the JOURNAL, that if the electrical industry cannot get on without such impositions as "French measurement," and misrepresentations of the cost of electric lighting, it will never do any good. Similarly, in much that we have stated respecting the shortcomings of the Crystal Palace Exhibition, our contemporaries thoroughly bear us out. For example, the *Electrician* recently remarked of this show that, while it contains "little that is new," inspection of the contents of the various stalls "brings home very forcibly the very stable and developed state which has been reached by makers of electrical machinery and apparatus." Just our opinion; and we also coincide in the slighting expressions used by our contemporary respecting the lack of artistic merit in a large portion of the lighting fittings. The most puzzling question for us is, What are our art critics about, that they do not think it worth while to turn their attention in this direction? How can one wonder that tradesmen botch and bungle these things, if they get no guidance from those whose taste has been formed in accordance with true canons? The hopeless poverty and crudity of many of the electric light fittings in the Exhibition, and the extremely fantastical character of others, are alike a grief to the beholder.

AN ILL-ADVISED PROSECUTION.

A LAWSUIT which presents several points of interest for gas managers and others more or less directly connected with the gas industry was determined by the Lord Chief Justice and a special jury at the last Manchester Assizes. This was the case of *The Queen v. Levinstein & Co., Limited*, in which the real prosecutors were the Corporation of Manchester; the defendants being a firm of chemical manufacturers carrying on business at Crumpsall. Although the proceedings were taken in the criminal form, the action was really of the nature of civil litigation commenced by the Local Authority for the protection of ratepayers. We are not concerned with the question of how matters of this kind can be most conveniently handled. That is for the lawyers. The gist of the affair is simple enough—it was the Manchester Corporation attacking a firm of chemical manufacturers for creating a nuisance to the neighbourhood in which their works are situated. It appears that Messrs. Levinstein, who are engaged in the production of coal-tar derivatives, recently made the preparation of naphthylamine a branch of their manufacturing operations at Crumpsall; and it was alleged for the prosecution that this new manufacture, the starting-point of which is naphthalene, had the effect of poisoning the air of the neighbourhood with evil-smelling emanations. The stench complained of was supposed to come from a particular stage of the naphthylamine distillation process, and was described as possessing most peculiar qualities. It was capable of travelling to enormous distances, and was worse when diluted with air than when first produced. It was also accused of causing nausea, diarrhœa, &c., in the human subject. In every respect, therefore, the complaint against Messrs. Levinstein was a very serious one. In instituting the prosecution, the Corporation of Manchester were inspired by their newly-born desire for purifying the atmosphere of the city and its suburbs—a most praiseworthy idea, doubtless, although taken up so late in the day that the Nuisance Committee, hardly knowing where to begin, seem fated to make nothing but false starts. At any rate, they failed in this instance; the Court refusing to convict Messrs. Levinstein upon the evidence brought forward. The Court took what appears to be the common-sense view—that residents in the neighbourhood of Manchester, or any similar locality, must take the place as it is, and must not be too "squeamish" in regard to a new odour or two, or any other incident of the development of the *genius loci*, provided that nothing has been done, either wilfully or through carelessness, to give unnecessary offence. Of course, there is a limit to tolerance in these matters. If a manufacturing process can be shown to be injurious to the health of people living in the neighbourhood, it will be no answer to plead that the process is carried on as well and as carefully as possible. The law will still say that the manufacture is an intolerable one, and must be stopped. All this is perfectly clear. Unfortunately for the Corporation, many of the witnesses whom they put forward to complain of Messrs. Levinstein's doings were unsuited, by their personal appearance, for the part of martyrs to chemical fumes which they essayed to play; and so the prosecution fell through.

Gas manufacturers are interested, as has already been remarked, in this litigation; and their interest is of two kinds. As owners of factories which come into the category of works from which noxious vapours are, can, or may be emitted, they are naturally concerned to watch proceedings for creating nuisance taken by local authorities and others against their fellows of the same industrial order. Gas manufacture is a business which may be credited with certain salubrious effects, notably in the matter of diminishing the smoke of towns by rendering possible the substitution of smokeless cooking and heating stoves for smoky grates and kitcheners. At the same time, a gas-works is not an establishment that would be regarded by owners of property as an improvement to a residential neighbourhood. Yet the arrangements and processes of gas-works have been very greatly improved of late years, sometimes deliberately, and of set purpose, for the abatement of nuisance, and quite as largely by what may be called consequential ameliorations—that is to say, incidentally upon the improvement of manufacturing and purifying methods. A good example of the latter is the modern working of gas-purifiers, with or without sulphur purification. Not many years ago, when Dr. Ballard investigated the subject for the Home Office, the emptying of the contents of the so-called "sulphide boxes," deemed to be an essential feature of sulphur purification, was productive of such an intolerable nusiance, that it was questionable whether a gas-works could be removed far enough from human habitations to permit of the process being carried on without offence, or whether the benefit of gas with a little less sulphur in it was not bought too dearly at the price of a whole neighbourhood deprived of charm for residential purposes. As then understood, in short, the question of the sulphur purification of gas was, for sanitarians, that of occasionally doing evil to the atmosphere surrounding the works, in order that some debateable good might be done to the air of the rooms of gas consumers. All this, or at any rate the worst of it, has now been changed; and no gas purifier need ever be opened to the air until its contents are perfectly inert, and incapable of giving offence. Now be it observed that this result

was not achieved by directly striving after an innocuous system of purification. The point to be dwelt upon in this connection is that no hardship, but rather benefit, would result from the application to a gas undertaking suspected of practising an old-fashioned, offensive system of purification, of the standard upheld among others in the Levinstein case—that manufacturing operations suspected of creating nuisances must be conducted according to the best known methods. If this can be proved, and the manufacture is not obviously prejudicial to health, the law will not hold it a nuisance. This legal obligation to carry on manufactures in accordance with the most approved systems, and with the employment of the most efficient machinery and appliances, is not so well defined or so generally observed as could be desired. We see by this Levinstein action that it applies in respect of the creation of nuisances; and it generally holds good with regard to the relations of manufacturers and traders with the public. Inside a factory, however, in the matter of the relations of employers to employed and the conditions of employment, the doctrine does not apply.

To return to the Levinstein case. The aspect of this affair which is of interest to gas manufacturers has reference to the peculiar nature of Messrs. Levinstein's operations. They make coal-tar colours, and they work up naphthalene; thus doing in England what has long been done in Germany, to the reproach of the English chemical industry. It was stated in evidence that the Crumpsall works are the only establishment in England where the preparation of naphthylamine is carried on. Until recently, this compound, which Messrs. Levinstein required in the ordinary way of their trade, had to be purchased in Germany; and it was only after the firm had decided upon making it for themselves that they were visited by a criminal prosecution. This is one way of "encouraging" the establishment of new industries in our midst. One of Messrs. Levinstein's assailants admitted in the witness-box that he had helped to ventilate the subject at public meetings, where he had asked whether the people were willing to tolerate "a German "Syndicate coming to Crumpsall and poisoning a thousand "inhabitants." The industry of the United Kingdom would not be what it is if all and sundry of every nation and kindred and tongue, having work to do, had not been welcomed to settle among us, and teach and employ our people, just as Messrs. Levinstein are doing, and as Brunner, Mond, Siemens, and a worthy company of traders and technicians have done before them, from the days of King Alfred downwards.

The manufacture of naphthylamine may or may not be a cause of contributing one more unpleasant odour to the by no means virgin atmosphere of Manchester; and it may or may not be an important branch of the chemical industry in itself, or the necessary support of others still more important. We regard it as something to be thankful for, so far as it goes, as a sign that the higher branches of the coal-tar industry are being gradually planted in this country, where the industry itself originated, and where the bulk of the raw material is produced. It has always been a mystery to us why the more recondite products of coal-tar must be purchased of German manufacturers. There may not be a great deal of money in the coal-tar colour and drug trade; but what there is may as well be made and spent in this country as on the Continent. It was asserted at one time that there was a difficulty in procuring trained young working chemists in England, owing to the absence of technical schools. If this complaint was ever justified, there ought not to be any point in it now.

It is worthy of notice, as bearing upon the importance of the coal-tar colour trade, that one of the witnesses called for the defence of Messrs. Levinstein was Mr. A. E. Fletcher, the Chief Inspector under the Alkali, &c., Works Regulation Act, who declared that "the industry involved in the manufacture of naphthylamine is a very important one nationally. Owing to the skill and energy of the German chemists, the manufacture of dyes representing about £3,000,000 is taken away from us; and we are very much indebted to Mr. Levinstein and his German friends for their efforts to establish the trade here, and retrieve our position." This is a worthy saying; but it is only what might be expected of Mr. Fletcher, who is in all respects devoted to the best interests of those industries over which he exercises an official surveillance that in unsympathetic hands might be made very irksome. Thanks to Mr. Fletcher and the other expert and resident witnesses called for Messrs. Levinstein, the jury had no difficulty in coming to a conclusion upon the questions submitted to them. They declined to put an end to an important and interesting industry; and the case ended with one more exposure of the occasional littleness and one-sidedness of Municipalism.

The Proposed Gas Pavilion at the Chicago Exhibition.—We learn from the *American Gaslight Journal* that, in immediate response to the appeal made by the Gas Industry Council of the Chicago Exhibition, to whom reference was made in the JOURNAL for the 5th inst., for support for their project of erecting a building wherein the gas industry may be adequately represented, about 12½ per cent. of the entire amount required ($200,000) has been promised; and of this the Consumers' Gas Company of Toronto, Canada, have pledged themselves for $2000. This is a splendid start; and the example will doubtless be speedily followed.

NOTES.

The First Colour of Heated Iron.

Mr. A. Noble writes to *Nature* respecting some remarks recently made by Lord Rayleigh as to the colour exhibited by heated iron when raised to such a temperature as only to be just visible in a dark room. Lord Rayleigh stated that Weber, who originally drew attention to the subject, described the first visible light as a greenish grey. Lord Rayleigh himself repeated the experiment by making a piece of thin iron part of the wall of a very dark room, and heating the iron gradually by an atmospheric gas-burner on the other side. He could not satisfy himself as to the greenish tint; but was convinced that no redness was apparent. Mr. Noble has had the idea of trying the same experiment by introducing a round bar of heated iron into a thin sleeve, by which means the latter would become heated slowly, so that the first appearance of visibility and the subsequent changes of colour could be observed. Two such sleeves were prepared—one of turned and polished iron; the other left with a thick coating of oxide. Two sets of experiments, in both of which six observers took part, were made. In each case the observers were in the dark room for some minutes beforehand. In the first set of experiments they gave their opinion, as a body, that the first appearance of colour was a greyish white; as the sleeve became hotter, the colour was yellow—gradually changing into orange. There was little or no difference between the observers as to the moment of visibility; and there was no difference in colour between the bright and oxidized sleeves. When the observers had no communication with each other, had no idea what colour they were expected to see, and gave their impressions independently, these agreed fairly well with the first statement.

A Thermo-Dynamical Photometer.

At a recent meeting of the Physical Society, Mr. H. M. Elder, M.A., read a paper on "A Thermo-Dynamical View of the Action of Light on Silver Chloride," which contained a suggestion of the basis of a chemical photometer. He stated that, in the decomposition of silver chloride by light, chlorine is given off, and a coloured solid body of unknown composition is formed; the reaction being indicated by an accepted formula. If the experiment is carried out in a sealed vacuum, the chlorine is darkened up to a certain point, but regains whiteness when left in the dark. These facts have led the author to think that the pressure of the liberated chlorine is a function of the illumination or intensity of the light falling upon the chloride, in the same way as the pressure of a saturated vapour is a function of the temperature. Since illumination is a quantity in many respects analogous to temperature, Mr. Elder considers it not unreasonable to apply thermo-dynamic arguments to the phenomenon in question, and to regard chlorine, in presence of silver chloride and the resulting compound, as the working substance in a kind of "light-engine." He therefore supposes a Carnot's cycle to be performed on the substances in question at constant temperature; the variables being pressure, volume, and illumination. Since the cycle is strictly analogous to Carnot's, except that illumination is written for temperature, Mr. Elder infers that the efficiency is a function of the two illuminations. It also follows that just as Carnot's cycle is used to determine an absolute scale of temperature, so this cycle may be applied to determine an absolute scale of illumination. It only remains to settle an empiric scale analogous to the air thermometer, and to compare it with the photo-dynamic scale, provided a method of making the comparisons can be devised.

A New Tar Roofing.

The somewhat misleading name of wood-cement roofing is given in Germany to a method of using coal tar for water-proofing the covering of temporary buildings which is largely employed by the German Government for military huts. The foundation is composed of ordinary boarding laid close, with a slight fall—say from 1 in 12 to 1 in 24. Upon this platform is first spread very fine dry sand to a thickness of about ¼ inch, overlaid with sheets of a particular make of cardboard, which is covered with the so-called wood-cement, laid on hot with a brush. The exact composition of this cement is kept as a trade secret; but the principal ingredient is stated to be coal tar, with which is incorporated sulphur, rosin, lamp black, coal dust, "and other substances." Five or six layers of pasteboard and cement are laid down alternately, and the last is covered while the cement is still plastic, with a coating of the fine, dry sand, which becomes incrusted in it. The originality of the arrangement is the combination of the cardboard and the tar composition to form a thin, light, and continuous impermeable covering, not liable to crack, and hardening with time. To protect this roofing from variations of temperature, it is sometimes further covered with 2 inches of fine gravel, and then with a little vegetable mould in which grass seed is sown, especially in situations exposed to strong winds. Care is taken to allow air to circulate underneath the wood platform, to prevent decay. The pasteboard is very strong, and is made from oakum. Everything depends upon the quickness with which the successive layers of "cement" are applied and covered up. The coal-tar composition is only melted, not boiled, in order to avoid the formation of bubbles. The employment of this system of constructing flat or terrace roofs is reported to be gaining ground. It is evidently cheap, and is stated to give great satisfaction.

COMMUNICATED ARTICLE.

THE PRESENT POSITION OF THE GAS-WORKS RATING QUESTION.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

Having shown in the article which has already appeared (see p. 575), the actual position of the parties concerned in the rating of gas-works, especially in regard to that of the user of gas, I proceed to offer some observations on the methods as established by precedent, that afford a means of arriving at a fair rateable value. Opinions may differ widely as to the extent to which a user of gas should be taxed, without injustice, for the benefit of his native parish or borough. In England, there are local authorities who have secured the gas undertaking ostensibly for the public benefit, but actually as a source of profit; and the revenues extracted from the gas consumers are said to go in relief of the rates. Whether this is really so, is a matter open for question; as instances are on record where they have been devoted to so-called improvements for which no pressing need existed, and for which the ratepayers would have objected to pay, if they had been at liberty to do so. On the Continent and in the United States, the gas consumer is still more unfortunate; and we hear of the sale of the rights to supply gas in districts by their respective local authorities, of rentals charged for the use of the roads (the fact of the mains being laid in them being considered to constitute a sort of occupation in addition to the liability to repair and make good any disturbance of the surface), and of shares of the profits being handed over to the local authorities. All these concessions, rents, or other payments are covered by a charge on the price of gas, similar to that required for the item of rates. Whatever form the transactions may take, they eventually come down to an item on the "Dr." side of the revenue account. But in England, at any rate, the general concensus of opinion runs in the direction of not taxing the user of gas to an extent greater than that allowable under the laws of parochial or borough rating; and all rates made upon the undertaking of a gas company are based upon the rateable value, as arrived at according to those laws. So that disputes between gas companies and assessment committees do not turn upon the main question of the right to levy rates, but on the manner in which the law, as admitted by both parties, is to be administered.

The fact that the law lays down as a first principle the rule that the rateable value should be equal to the rent which a tenant would be willing to give for the property from year to year, admits of several generalizations that are independent of the means pursued in arriving at that value. An assessment once decided upon is intended to hold for several years, or so long as no changes occur that are likely to affect the valuation to any important extent. It is never made for less than five, and often holds good for ten or twenty years. In order to get a fair average for the rent that would be paid "from year to year," it is obvious that all extraordinary circumstances must be left out of consideration, and a fair average year's working must be taken as the basis. The assessment committee must not pick out an exceptionally good year, when coal is cheap or the consumption of gas abnormally large, nor may the gas company rely upon a bad year. If a valuation is to hold good for one year only, then a fair value based upon that year's working must be taken. Fortunately, the difficulty involved in defining the constitution of a fair average year, or the definition of what is or is not an extraordinary expenditure, need not arise in the case of English statutory companies, because they are limited with regard to profits. In most cases, they are able to declare maximum dividends; and therefore it is easy to forecast for some years ahead, what the actual profits divided amongst the shareholders will amount to. With companies subject to the sliding scale, this arrangement could be easily extended to include the rateable value; and a proportionate adjustment for increase of capital can be made with equal ease. The fact of a tenant taking over the concern could not alter existing parliamentary regulations; and he would take it subject to the privileges and obligations conferred by such regulations. Assuming that the maximum rates of dividend allowed by the Special Act represent a sum of £5000, the gross profit that a tenant could expect to realize would be limited to that amount. If he appropriated an excess of £500 or £1000 beyond that sum, he could be forced to restore the same to the consumers, exactly as a company would be made to do. He would be under the same obligations as to furnishing copies of accounts and so on. To show on paper, then, that the concern is capable of yielding a profit of £5500 or £6000 per annum, is simply a misstatement of the case; for the £5000 is the only part that is of any benefit to the tenant, and if the concern made £7000 he would be no better off. It is not possible to conceive of any legal means of applying excess profits, over and above those represented by the statutory rates of dividend, to the direct benefit of the shareholders or of a tenant.

Sometimes it happens that a gas undertaking, being loaded with a large capital or subject to some other disadvantage, does not consider a division of the full rate of dividends advisable in the interests of the concern. In this event, it is easy to define the rate of dividend that will be paid, and to substitute the same for the maximum rate, which is only recommended for adoption when it is actually paid. If the company cannot be worked to pay maximum dividends, a tenant could not reasonably expect to earn them. In any case, it is easy to decide the amount of profit that will actually be divided; and by this means to get at a fair estimate of the gross profit.

Such a method would certainly be more likely to afford a fair basis for valuation than estimates based on a so-called average year. The custom is to take, for the purposes of the valuation, the most recent set of audited annual accounts that may be available; and it rarely happens that both parties are willing to accept them without corrections for extraordinary circumstances. These corrections are to a large extent the result of opinions of experts, supported by arguments rather than by incontrovertible facts. The amount actually paid to the shareholders, is easily proved by the bank-book. Assuming the valuation to stand for not less than five years, any variations due to unusual circumstances would be neutralized; and to say the least, the payments would be more just and fair than any based upon a valuation fixed by an independent and often unpractical tribunal, after hearing expert evidence and the arguments of counsel for and against.

It has become almost a custom to ignore the amount actually divided, and to base the valuation on the net receipts as shown by the accounts. As a general rule, these have been more than the payments, as they included sums carried to reserve funds, &c. So long as this state of things obtained, the valuers against the companies have been careful to maintain this condition unaltered; but in the recent appeal of The Gaslight and Coke Company, the Court had to deal with the fact that only about two-thirds of the profits divided were actually furnished by the earnings, the remainder coming from the reserve fund. According to previous valuations, all balances of profit have already been rated; and yet one valuer contested that, under these abnormal circumstances, the actual amount of profit divided should form the basis for the valuation. It usually happens that not only are the full dividends paid, but the reserve fund is maintained; and therefore the cases in which the substitution of a valuation based upon the actual divided profits for one founded upon net receipts, would bring in part of the profits to be rated twice over, are few and far between.

Given a certain amount of profit earned, that amount cannot be paid to the shareholders more than once, whether they receive it at the next half-yearly division of profits, or not until after some period of years, during which time it has represented either a part of the reserve fund or of the undivided balance. As it can only be paid once, it can only be rateable once; and it seems fairer that the rate should be paid when it is actually divided rather than when it is earned.

Assuming that the average dividend actually paid—which for our purpose may be regarded as the maximum rate allowed by Parliament—is taken as the gross profit, that sum will be divided between the landlord and the tenant. The former receives a rent for his property, and the latter a trade profit and interest on his embarked capital. The rent is the same amount as the rateable value; and it follows that this must be *considerably less than the whole gross profit*. The tenant will not be willing to undertake the responsibilities attached to the working of a gas-works under lease merely as a means of securing an average rate of interest on his capital, nor will he be satisfied with a small remuneration in addition. Apart from the help derived from the skilled assistants whose stipends are represented in the accounts, he would give regular personal attention to the progress of affairs generally. A yearly tenant cannot be in any sense likened to a shareholder or a sleeping partner; and the providing of the floating capital only, as required for carrying on the business, is a very different thing from an investment in the shares of the concern. The position of a lessee is vastly different from that of a shareholder; and the tenant would feel that there was risk of depreciation and loss, and would expect not a small, but a substantial share of the profits for himself. In short, he must be a man of position and means, who would not care to take the lease of the gas-works unless he could secure as handsome a return as might be obtained by embarking in any other branch of manufacturing or commercial enterprise. In many businesses, the floating capital can be "turned over" many times in the course of a year; but in taking over the parliamentary obligations, he would also take the privileges, and having an eye to these he would be satisfied with a reasonably moderate business profit. These may be taken as some of the characteristics of the imaginary personage who has figured largely in rating questions generally during the last half century under the title of the hypothetical tenant. An hypothesis must have some foundation in fact, and so this mythical individual is built up on the patterns of existing personages and practice.

(*To be continued.*)

Death of Dr. Tripe.—We regret to record the death, in his 72nd year, of Dr. John W. Tripe, Medical Officer of Health for the Hackney district. He had filled the above office ever since the formation of the district 36 years ago; and he was also its Public Analyst. He was a great authority on sanitary science, and took a prominent part at the recent Congress on Hygiene and Demography in London and at the Sanitary Congress at Worcester. He was the author of several works on sanitary questions.

TECHNICAL RECORD.

SOUTH-WEST OF ENGLAND DISTRICT ASSOCIATION OF GAS MANAGERS.

The Visit to the Severn Tunnel.

At the close of the report of the proceedings at the meeting of the above Association in Bristol on the 12th inst., which appeared in the last number of the JOURNAL, we briefly recorded the fact that on the following day the members and visitors, to the number of about fifty, inspected the Severn Tunnel, accompanied by Mr. C. Richardson, whose interesting paper descriptive of this important work had formed the principal item in their programme of business. We are now able to give a more extended account of the visit. It should be mentioned, at the outset, that all the arrangements necessary for the convenience of the party had been previously made by the President of the Association (Mr. D. Irving); and through the kindness of Mr. H. Lambert, the Manager of the Great Western Railway, two saloon carriages, and a special engine at the junction, were placed at their disposal. Joining an ordinary train at 9.45 a.m., the party were conveyed through the tunnel to the Junction Station, about two miles on the Welsh side, which was reached in about an hour. The time occupied in passing through the tunnel was 7½ minutes.

In order to make the principal features of the visit clear, it should be explained that the chief difficulty encountered in the construction of the tunnel arose from springs of water. There was but little trouble in the way of leakage through from the Severn; and the tunnel is practically sound in this respect. But to keep it clear from spring water, three pumping-stations are necessary. Two of these—known as "Five mile four" and "Sudbrook" respectively—are on the Welsh side; and the third, which is called "Sea Wall," is on the English side. The chimney-shafts of the two last-named stations form a guide as to the course of the tunnel, which lies in a direct line between them. Sudbrook is situated on the water's edge, as nearly as possible over the central part of the tunnel, and is by far the largest of the three—having to raise water from a level 40 feet below that at the other stations. "Five mile four" and "Sea Wall" act as intercepting stations at each end respectively; collecting and removing surface water and drainage before it can flow to the lowest part of the tunnel. The length of the tunnel proper is 4¼ miles; and besides this there are the approaches at each end, which of necessity extend a considerable distance in either direction, as the difference in altitude between the lowest part of the tunnel and the prevailing level of the lines of railway connected by it is 240 feet. These approaches are protected by the massive earthworks described in Mr. Richardson's paper, in order to avoid risk of getting the whole flooded at high tides. Passengers by the old ferry system at Portskewet will well remember the great difference between high and low tides at that point, which is 50 feet under ordinary circumstances, and occasionally much greater.

In the course of the journey, Mr. Richardson pointed out two or three bridges, built of brickwork on the vertical bond system he had described on the previous day, and illustrated in his paper. They presented a thoroughly satisfactory appearance; being free from cracks or other signs of weakness, although the arch segment was only 18 inches thick—about half that usually observable. The lightness and elegance of outline, as compared with ordinary brick arches, was very prominent; and, apart from the saving of bricks, the reduced thickness at the crown of the arch is a great advantage in many localities.

On arriving at the Junction Station, the party received a kindly reception from Mr. R. Hosken, the Resident Engineer, who was awaiting them. The programme for the day comprised a visit to "Five mile four" and to Sudbrook; after which a return to the junction would enable the carriages to be joined to an ordinary train, and conveyed back to Bristol. At "Five mile four" the party were shown the pumping plant, which included six Lancashire boilers, and two beam engines, each having cylinders 65 inches in diameter, and 10 feet stroke. One engine worked a plunger-pump 35 inches in diameter and 9 feet stroke, capable of delivering 356 gallons of water at each stroke, after deducting 5 per cent. for slip. (This deduction is made in each case mentioned later on.) The other worked a bucket pump 34 inches in diameter and also 9 feet stroke, capable of delivering 336 gallons at each lift. As these can be worked at eleven strokes per minutes, they are capable of dealing with 7600 gallons of water in that time. The shaft at this station is 160 feet deep. These engines, as well as those at the other stations, were constructed by Messrs. Harvey, of Hayle, Cornwall. The peculiar form of gearing adopted, by which avoidance of shock is secured, was inspected with great interest. It causes a quick up-stroke, a pause, a slower down-stroke, and a second pause. This is adopted on all the engines.

Re-entering the carriages, the party proceeded to Sudbrook. Here the chief feature of attraction to the more adventurous members of the party was the prospect of a descent of one of the shafts, and thence into the tunnel itself. Groups of half-dozens were arranged, and waterproof coats, leggings, and sou'-westers served out. The appearance of the first detachment (which included the President, the Vice-President, the Honorary Secretary, and Mr. W. A. Valon), in full "war-paint" for the descent, created much amusement, derisive calls for a photographer, &c. There are three shafts at Sudbrook—29 feet, 18 feet, and 12 feet in diameter respectively; and the largest was selected. It is 180 feet deep, and contains six pumps, which are worked by beam engines; the shaft being situated in the centre of the engine-house, with three engines on either side. The cylinders are 70 inches in diameter and 10 feet stroke; and there are three bucket and three plunger pumps, in size similar to those at "Five mile four." To two of the plunger pumps there is attached a 12-inch pump, which forces 42 gallons of water per stroke into a tank at the top of the building, whence the water supply for the district is taken. The quantity of water raised from this shaft varies according to the rainfall, and ranges from a maximum of 17½ to a minimum of 9½ gallons per 24 hours. It comes from an enormous land spring, the tapping of which drained all the neighbouring wells; and the water is now supplied as from an ordinary water-works. In anticipation of its being eventually utilized for the supply of some of the neighbouring towns, it is kept quite clear from tunnel drainage or any contamination. A special brick culvert has been constructed parallel to the tunnel, to bring it to the pumps. On reaching the bottom, the plungers and other parts of the pumps were examined; also a specimen of the pump-valve used. This is a most ingenious contrivance, arranged to open at full bore with a small movement, and furnished with wings placed at an angle so as to give the valve a slight rotary motion at each rising; thus causing it to bed in a different place at each falling, and keep itself true. The visitors were then taken along the culvert above mentioned, to see the source of the big spring; and they subsequently passed through a narrow passage into the tunnel itself—the point where they entered being at the lowest level, and nearly equidistant from either end. A gang of platelayers happened to be at work close by; and the paraffin lamps used by them gave quite an animated appearance to the scene. The ventilating arrangements are so effective that the men are able to work as comfortably as in the open. Some of the party had the satisfaction of being in the tunnel while a train passed. The first intimation of the approach of a train is a strong draught or wind, as immediately the tunnel is entered the train drives the air before it like a piston. The word was given to "Stand clear for the up-train;" and soon the train rushed by at a tremendous speed, having gained impetus by running down the approach into the tunnel, and reserving it for the ascent. It came without warning out of the darkness, and vanished again with equal rapidity. Even immediately after it had passed, the air was not so foul as that in many parts of the Metropolitan Railway; and on proceeding to the large ventilating-shaft close by, the rapid up-draught of the smoke could be seen by the light of the lamps, and in a few minutes all traces of it had disappeared. On returning to the surface, the boilers and engines were inspected. There are 40 large boilers; and, in addition to the six engines just mentioned, there are three at the 18-feet shaft, two having 50-inch cylinders, and the other a 75-inch cylinder, and each a 10-feet stroke. At the 12-feet shaft an engine with a 70-inch cylinder and 10-feet stroke was driving the largest pump on the works, which has a 37-inch plunger, and delivers 442 gallons of water per stroke. The inspection of these pumping-engines called up many interesting reminiscences of William Murdoch, and the active part he took in the development of this kind of machinery. It is necessary to see the flow of water from the outlet of this pump in order to realize the quantity raised. It was stated that the contents of the rising main alone represented 60 tons of water. These engines deal with the "tunnel drainage." On the top of the ventilating-shaft above mentioned is a large Guibal fan, 40 feet in diameter and 12 feet wide. It is driven by a compound horizontal engine, and is capable of withdrawing from the tunnel 250,000 cubic feet of air per minute. A large cloud of smoke was escaping from its outlet. The quantity of water raised at the three stations has reached upwards of 30 million gallons per 24 hours, and at the time of the visit about a million gallons per hour were being pumped.

The party assembled near the entrance, and were photographed by Mr. Butler (of the firm of Messrs. W. Butler and Sons, of Bristol), who has attained some celebrity as an amateur photographer, and kindly offered to present each member of the party with a copy as a souvenir of the visit. The President then called for a hearty recognition of the courtesy and kindness extended to the Association by Mr. Hosken, his assistant (Mr. Richards), and the staff on the works, who had done everything in their power for the convenience of the visitors, most of whom had been able to descend the shaft and visit the tunnel in comfort and safety. This was energetically responded to; and Mr. Hosken briefly replied. Then, in response to repeated calls, Mr. Richardson came forward to address a few words to the company; and he was received with loud cheers. Subsequently the party returned to Bristol, which was reached about three o'clock, after having one of the most interesting and enjoyable outings that has ever fallen to the lot of the Association.

The Honorary Secretary (Mr. Norton H. Humphrys) has asked us to state that, as the result of an impromptu collection among the party, for the benefit of the medical and provident fund at the Severn Tunnel works, he has been able to forward to Mr. Hosken a cheque for £2 2s.

THE DEVELOPMENT OF GAS LIGHTING IN RAILWAY TRAINS.

A Paper read by Mr. E. C. Riley (Great Western Railway Works, Swindon) at the Meeting of the South-West of England Association, April 12.

As I have only consented to fill a gap at the last moment, I will not apologize for the brevity of the paper I propose reading—especially as it can only occupy the humble position of a side dish, to the great central attraction of our intellectual bill of fare to-day, in the valuable and interesting paper on the "Severn Tunnel" by Mr. Chas. Richardson [see *ante*, p. 705]. I also find that the meetings of other District Associations held at this time of year dispense very largely with lengthened or exhaustive papers.

I have thought it may be interesting to the members to know something of the quiet and yet important revolution that is steadily proceeding in the lighting of our railway trains. My predecessor in the Gas Department of the Great Western Railway (Mr. Botley) read a paper in June, 1883, before the members of The Gas Institute, at the Firth College, Sheffield, on the "Lighting of Railway Carriages;" but the development since that date (when, at any rate as regards its application to main-line trains, gaslighting was comparatively in its infancy), has been both rapid and important. I may say that at that date the "Battle of the Gases" was being fought out; and railway engineers and managers had not come to any definite conclusions as to the kind of gas and lamp most suitable to the various conditions and requirements of actual railway working.

The principal competitors for the place so long and so unsatisfactorily occupied by the oil roof-lamp, were: (1) Coal gas uncompressed; (2) coal gas compressed; (3) coal gas compressed and carburetted; (4) cannel gas compressed; (5) oil gas compressed.

The first system referred to is the ordinary coal gas, as made and supplied in the towns in which the railway is situated, obtained from the town main at the ordinary pressure, and stored either on the roof, under the carriages, or in the guard's van, as might be preferred. The only survival of this system still in use on any large scale that I am aware of, exists on the North London Railway, where the comparatively short journeys and the permanently made-up character of the trains lend themselves advantageously to this arrangement. On this line, the gas is stored in expanding holders in a part of the van specially provided, and containing a supply sufficient for about three hours' consumption. As time is an important element in the working arrangement of London suburban trains, special provision is made for the rapid replenishing of the holders at the terminal station by flexible gas hose pipes, about 6 inches in diameter, fitted with spring ball-valves and sockets, admitting instantaneous connection with the holders, which by this means can be filled in one minute. No more time, therefore, is required for gassing, nor so much, as is needed for changing engines and emptying and refilling the train with passengers. The supply of gas for each carriage is conveyed from the vans at each end of the train by pipes along the roofs of the carriages, with flexible connecting tubes between each carriage; and no regulator or governor has been used, as the pressure obtained in the holder from the mains gives an approximate burning pressure by the time it reaches the burners. The burners hitherto used have been the ordinary union type, usually about No. 4, but recently replaced by a simple regenerative burner of a useful and durable type for railway purposes. This system is efficient and useful where the trains are always made up and work regularly at short intervals into stations where a plentiful supply of good coal gas can be obtained at a pressure of not less than about three inches, and of course at a reasonable price; also where the companies do not limit the effect by providing a smaller number of lights than there are compartments to be lighted, or using smaller burners than are really necessary for effectual lighting—the practical standard of efficiency being ability to read an ordinary newspaper or book in any part of a compartment when the train is running at its highest speed.

The second system of those I have referred to as competing for the railway train lighting of the future is that of compressed coal gas. In this system, we have to confront the fact of the loss due to compression necessitated by the conditions of storeage essential to compliance with the requirement that each carriage shall provide, separately and independently of the rest of the train, its own supply of light—of course, in the smallest possible space, and involving the carrying of the smallest possible amount of additional weight. To comply with these conditions, iron or steel reservoirs are provided under each carriage, of a total capacity of about 20 feet at atmospheric pressure, and filled to a pressure of 6 to 9 atmospheres, according to the class of work the carriage may be employed on. The reservoirs on the carriages are filled from large stationary reservoirs, into which the gas has been compressed by special pumps from the holder to about 10 atmospheres; or from travelling reservoirs which have first obtained their supply from the stationary reservoirs, the higher initial pressure in the original receptacle providing the necessary force for filling the secondary travelling supply or the final storeage vessel of each carriage. Contrary to the views of some previous writers on this subject, a considerable loss, both of bulk and illuminating power, occurs in the process of compression, in the deposition of hydrocarbon and water. From a series of tests made, in which I had the assistance of Mr. F. G. Dexter (now of Winchester), I found a loss of 49 per cent. in illuminating power in compressing to 13½ atmospheres. We were able to confirm from our own experiments the power of the gas to take up again a portion of the hydrocarbon deposited under pressure as the pressure is reduced; but this power is not sufficient to be of any practical value in ordinary working. I have had considerable experience during the last five years of this system; and very useful and fairly efficient results have been obtained. For about three years, a train lighted in this way was running continuously for the purpose of effectually ascertaining its merits or disadvantages as compared with compressed oil gas, which was in use in other parts of the system. In experimenting with this train, I tried fourteen different burners, including plain ungoverned, governor, duplex, table-top, fish-tail, and several modifications of burners of regenerative type. A long chapter could be written on these trials; but as for general working, there were two important objections to the use of compressed coal gas at all (whatever might be the character of the burners or the working out of any minor details). They are of no present interest, and may be relegated to the comparative oblivion of the note-books and memories of those who worked them out. The two fatal objections to compressed coal gas for railway train lighting are, first, the low illuminating power of the gas; and, second, as a result, the large amount of storeage required to provide sufficient light for a long journey without the necessity for replenishing the supply occurring before reaching a station where the necessary provision was available. The most efficient and reliable result obtained was by burning 4 feet of gas through a plain No. 8 fish-tail governor burner. One of the best examples of this class of lighting may be found in the travelling post-offices working between Gloucester, Swansea, and Milford Haven.

The third system is one that perhaps gas engineers at present may feel the most interest in, but which has proved so far least amenable to the variations or special conditions of railway working. I now refer to carburetted coal gas (compressed). As every gas manager or student is aware, a great variety of carburetters have been invented, and I think I may say *re-invented*, after a sufficient interval has passed for the previous one to be forgotten or lost sight of; and it is only natural that some attempt should have been made to apply the principle to railway-carriage lighting. The records of experiments in this direction do not appear to be very numerous. Mr. Bower experimented on the Great Northern Railway with both liquid and solid hydrocarbon, and took out a patent; but the matter eventually dropped. Mr. Pope, of Slough, also produced a carburetter for coal gas, and tried various experiments; but he relinquished his efforts in that direction in favour of oil gas. Mr. Botley tried albo-carbon; but was unable to get a result that would be practically uniform and reliable under all the varying conditions of railway working. I myself made experiments and constructed a carburetter, which was subjected to a variety of tests in the laboratory; but the results were not such as to give a reasonable prospect of fulfilling the conditions necessary on a train. Any carburetted gas used for train lighting should either be raised to the standard of illuminating power of oil gas, before being put into the carriage reservoir, so that no additional storeage beyond present provision would be required, or else it would involve an arrangement for carburetting as used, which so far has proved impracticable in surmounting the difficulties of temperature, air supply, and all the vicissitudes of railway working. It is also undesirable to carry on a passenger vehicle any quantity of a substance of such a very inflammable character as is the liquid necessary for carburetting.

The fourth system is that of cannel gas. I cannot find that much has been done with this gas in railway-carriage lighting. Mr. Sugg's trials appear to have been the most noticeable. In cannel gas, as in oil gas, it is simply a question of cost and convenience. Within reasonable limits, the gas that gives the greatest amount of light with the least storeage room, and consequently dead carrying weight to the train, and involves least interference with the train apparatus and working, is likely to be the favourite; and if cannel gas can be supplied at the same cost as oil gas of the same illuminating power and with the same general convenience, there is no reason why it should not be equally valuable. But the scarcity and high price of cannel, and the possible uncertainty of its constant supply and uniform character, tend to promote the use of the plentiful petroleum or shale oil gas.

I now come to the fifth and last of the principal competitors for railway train gas lighting—I mean oil gas. Every student of gas manufacture is aware that oil gas as an illuminant has a long history; but as our subject only refers to its application to the lighting of trains, I need only mention that the system was adopted first with success in Germany in 1871, and reported on by the Committee of the Society of Arts on "Railway Train Lighting" as being the best existing for that purpose. The gold medal of the Society was, on the reception of the report, awarded to Julius Pintsch, of Berlin, for the practical and successful application of oil gas for the purpose of train lighting; and from this time its development has been continuous, although at first "with cautious steps and slow." The Metropolitan Company adopted Pintsch's system in 1876, since which date it

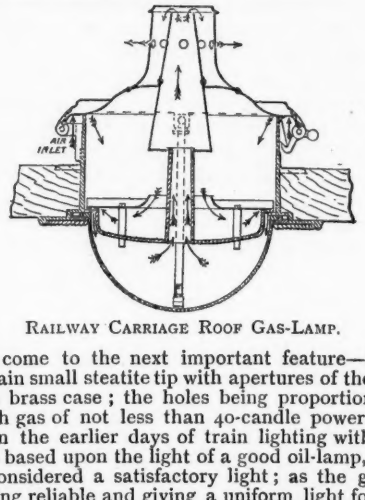
has been in constant use with unfailing satisfaction and without a hitch—at an average cost of 0·66d. per train mile, as against 1·31d. per train mile for uncompressed coal gas. Following the Metropolitan, the Great Eastern Railway, with its extensive suburban train service, adopted oil gas; and then gradually this system was taken up by the London and North-Western, London and South-Western, and other large railway companies, until now most of the leading companies of England and Scotland have commenced applying it to part of their stock.

The two firms that have taken the lead in the working out of the application of oil gas to train lighting on any large scale are Pintsch's Patent Lighting Company and Messrs. Pope and Sons, of Slough. Both these firms have taken out patents for the lighting of railway carriages and the apparatus connected therewith, in each case including a governor or regulator for the reduction of the high pressure of 8 or 9 atmospheres, at which the gas has to be compressed in the storeage holders under the carriages, to the low pressure of 6-10ths or 8-10ths required at the point of ignition. Owing to the prominence of these firms, the terms "Pintsch Gas" and "Pope Gas" have been so frequently used that, outside a comparatively small circle of experts or readers who are familiar with the principles and processes of oil gas manufacture, the impression largely obtains that gases of decidedly distinctive characteristics are meant. As a matter of fact, the gas produced by the Pintsch, Pope, Keith, or other numerous modifications of oil-gas plant used by various railway companies or other firms, is practically the same in general character and leading features; the differences, where they exist, being due usually to variations in the quality of oil used and the temperature of distillation.

Messrs. Pintsch and Pope both use two retorts for carbonizing—the first to crack or split up the liquid hydrocarbons, and the second to fix the vapour into permanent gas. In the former case the oil is run into the top retort *first*, then passed into the bottom for fixing, and conveyed *downwards* to a hydraulic main placed on the floor, from which it is taken to a vertical plate condenser, and then through a simple washer and a purifier (containing lime and sawdust) to the meter and holder; while in the latter system, the oil is run into the bottom retort first, then passed to the top retort, from which the gas *ascends* to a hydraulic main above the bed, and then on through a vertical pipe condenser to a dry scrubber or scrubbers, from which it passes to the meter and holder. It will be seen from the brief outline just given of the general arrangement of the plant, that the question of purification is much simpler than that of coal gas, owing to the almost entire absence of sulphur.

Passing from the question of manufacture to that of distribution, we come at once to an entirely different set of conditions to those of coal-gas supply for town lighting. Oil gas for trains, in order to be in a condition available for use, must be stored at a high pressure. Consequently, the ordinary type of gasholder is used only as a temporary receptacle into which the gas passes as manufactured. From this holder, it is drawn by specially-constructed compressing-pumps (which it does not come within the scope of this paper to describe), and forced into large cylindrical steel or iron tanks or reservoirs, from which it may be either taken in travelling tanks to any point where it is required for use, or conveyed in high-pressure pipes to valves or hydrants placed in the sidings, sheds, or stations, where it will be most convenient to gas the trains. This latter process is effected by connecting a flexible pipe to the valve on either the travelling tank or high-pressure main, and connecting to the storeage cylinder or holder under each carriage. We will now assume the holder on the carriage is filled to 8 atmospheres. The high-pressure gas is then passed through a governor, reducing it to a suitable burning pressure; and from the outlet of the governor it ascends the main supply-pipe to the carriage roof. On this pipe is placed the main cock actuated by a slide rod, the handle of which is in a convenient position for working from the platform or side of the train.

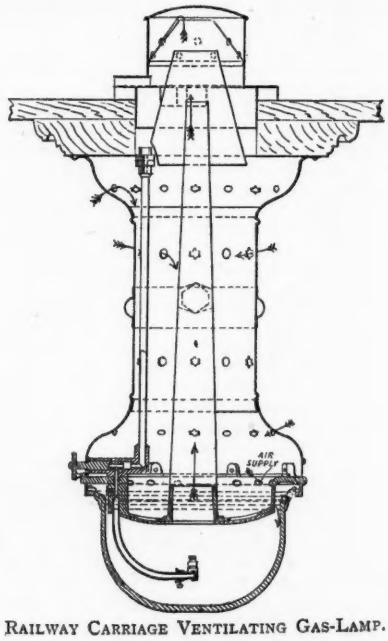
We now come to the lamp itself. This from the beginning has invariably been placed in the roof in the position hitherto occupied by the oil-lamp; and several points of difficulty presented themselves in overcoming the varying conditions of railway working. The first point was the ventilation. It was necessary that the supply of air for combustion should be introduced in such a manner that the flame should be fed with practically the same regularity, when the train was standing still in a snug, covered, terminal station, as when rushing along a high embankment at a mile a minute, exposed to the sweep of the wind from a bleak moor or the open sea. This effect was secured in the first place by the arrangement of the holes and baffle-plates in the lamp-lid; so that, however strong the current of air outside, its course to the flame was so contrived that practically no trace of the rough wind outside reached the secure stillness of the inner globe. The next point was the removal of the products of combustion into the outer air; so as to avoid any vitiation of the atmosphere of a small compartment, when, from the condition of the weather, it was undesirable or disagreeable to open the windows. This result was also obtained by the special construction of the lamp lid or cover on the top of the carriage; which usually was also the only mode of access to the interior of the lamp for lighting, cleaning, &c. I have here a section of an ordinary type roof-lamp, which illustrates the usual arrangement for ventilation and discharge of the products of combustion. It will of course, be understood there are many modifications in the construction of the lamp, in minor details; but nothing affecting the general principle in the ordinary lamp ventilated from the outside.



Railway Carriage Roof Gas-Lamp.

We now come to the next important feature—the burner. This is a plain small steatite tip with apertures of the union type fitted into a brass case; the holes being proportionately small to suit a rich gas of not less than 40-candle power when compressed. In the earlier days of train lighting with oil gas, a small flame based upon the light of a good oil-lamp, when at its best, was considered a satisfactory light; as the gas had the merit of being reliable and giving a uniform light for the whole of the time it was in use, and in the early advocacy of the use of oil gas, the consumption per lamp was given at 0·5 cubic foot per hour, and calculations of cost were made accordingly. Here, I think it only right to acknowledge (as every gas engineer and manager should readily admit), that we are indebted to our rival the electric light for raising the general standard of lighting, and setting up requirements that demand, and are ensuring, that the gas lighting of trains shall be something superior to the small burner of from 3 to 6 candle power first used; and several railways that have experimented to some considerable extent with the electric light, but have now adopted gas lighting, are in consequence using larger and better lamps and burners; the consumption per burner being nearer 1 cubic foot than the ½ foot previously used. It was also found that, owing to the usually dark nature of the upholstering of the first-class carriage, the same lamp which gave a good reading light in the plainer and more slightly upholstered second and third class was insufficient in the first. This led to two lamps being placed in each compartment, one on each side; and then to the adoption of duplex and even triple burners, burning 1½ and 2¼ cubic feet respectively.

The next step forward in lamp construction has been to combine the two features of lighting and ventilation in one lamp—in what I may describe as the most recent and perfect development of railway lamp. This has been effectually done by taking the air required for combustion from the inside of the carriage, and discharging the whole of the products through a fixed cover on the outside of the carriage, access to the lamp itself being obtained from inside. A lamp of this type has been adopted in the new carriages of the Great Western Railway Company, as it is specially constructed to suit the lofty omnibus ventilating roofs which travellers on that line are already familiar with; and by the kind permission of Mr. Dean, the Locomotive and Carriage Superintendent, under whose direction the new carriages are



Railway Carriage Ventilating Gas-Lamp.

being built and fitted with gas, I have been able to provide a section, showing the principle of construction and a sample of the lamp lit with oil gas. This lamp, fitted with duplex burners, gives a light of 13¼ candles, with a consumption of 1½ cubic feet of gas, as against 3 candles, which is the maximum of a good oil-lamp, with a consumption of 500 grains of rape oil per hour. It affords sufficient light to read a newspaper in any part of the compartment with perfect comfort, even when the train is travelling at its highest speed. The new corridor train built recently at Swindon, a description of which appeared a few weeks ago in the *Graphic* and other London and provincial papers, and which is now running between Paddington and Birkenhead, is fitted with this lamp.

The largest works for the manufacture of oil gas for train lighting are those recently erected for the Great Northern Railway at Holloway; and though only working to a small proportion of their capacity, they are a striking illustration of development in the gas lighting of trains which this paper endeavours to show.*

Nearly all the Railway Companies running into and about London and suburbs are lit with gas; and it is extending with great rapidity. The great trunk lines are fitting up their stock with gas apparatus and lamps; and soon a comfortable carriage well lit with gas will be the privilege of most railway travellers, while the old oil-lamp with its erratic behaviour, so often denounced as a disappointment, a delusion, and a snare, will take its place with the stage coach and rushlight of ancient history.

By the courtesy of Messrs. Pintsch, Pope, and Laidlaw, I have obtained the following figures showing the development of oil-gas manufacture and lighting by these firms:—

Name of Firm.	Gas-Works Erected.	Railway Carriages Fitted.	Oil-Gas Lamps Supplied.	Tram-cars Fitted.
Pintsch . .	150 ..	40,000 ..	150,000* ..	—
Pope . . .	15 ..	10,354 ..	40,000 ..	90
Laidlaw . .	— ..	— ..	8,000 ..	—

* Estimated.

These figures are exclusive of what may have been done by Railway Companies or other firms.

I have taken, for this meeting, a series of tests of the illuminating power of coal gas compressed to various pressures; the results of which are shown in the following tables:—

Statement of Tests of Compressed Coal Gas for Railway Train Lighting.

Date of Test.	When Gas was Compressed.	Pressures. To which originally Compressed.	Pressures. In Cylinder at Time of Test.	Temperature of Gas.	Illum. Power. Gas Uncompressed.	Illum. Power. Gas Compressed.	Percentage Loss on Compression.
1892.	1892.	lbs.	lbs.	Deg. F.	Candles.	Candles.	
Mar. 16 .	Mar. 14 .	150	132	69	14·17	9·50	32·9
" " .	" " .	150	130	69	14·17	9·00	36·4
" " .	" " .	150	128	69	14·17	8·26	41·7
Mar. 18 .	Mar. 14 .	150	100	72	14·17	11·49	18·9
" " .	" " .	150	75	72	14·17	10·67	24·7
" " .	" " .	150	50	73	14·17	10·42	26·4
Mar. 21 .	Mar. 14 .	150	25	60	14·17	10·96	22·6
" " .	" " .	150	15	61	14·17	10·44	26·3
" " .	" " .	150	5	61	14·17	11·75	17·0
April 5 .	April 5 .	20	20	66	15·83	15·77	0·37
" 7 .	" 7 .	50	50	67	15·50	15·04	2·9
" 8 .	" 8 .	100	100	62	15·50	12·79	17·4
" " .	" " .	150	150	65	15·50	10·86	29·9

Remarks.—In the tests made during March, the gas was compressed, through the catch-box, into a 10 cubic feet cylinder, to 150 lbs. per square inch, and the pressure was afterwards relieved. In the April tests, the gas was compressed direct into the 10 cubic feet cylinder without passing through the catch-box.

Tests of Oil-Gas Burners for Railway Train Lighting.

Description of Lamp.	Gas consumed per Hour.	Illuminating Power. Total per Lamp.	Per Cub. Foot.	Per Burner per Foot.	Per Burner.
	C. Ft.	Candles.	Candles.	Candles.	Candles.
Triple burner .	1½	8·67	5·78	1·93	2·89
" " .	2	11·18	5·59	1·86	3·73
" " .	2½	19·52	7·80	2·60	6·51
Duplex burner .	1	8·20	8·20	4·10	4·10
" " .	1½	13·25	8·84	4·42	6·62
" " .	2	17·08	8·54	4·27	8·54
Single burner .	½	3·70	7·40	7·40	3·70
" " .	¾	5·52	7·36	7·36	5·52
" " .	1	7·56	7·56	7·56	7·56

I have not been able to do quite as much as I wished in this direction, but as much as the time I had available would allow; and as the question of illuminating power in relation to storeage capacity is of such importance in train and tramway lighting, also for buoys and beacon lights, I have shown these results for the information of the members.

* This plant was fully described in an article appearing in the JOURNAL for April 21, 1891 (p. 740).

THE ENRICHMENT OF GAS IN BULK BY MEANS OF CARBURETTERS.

A Paper presented by Mr. F. W. Clark at the Meeting of the South-West of England Association, April 12.

The question of how best to enrich ordinary coal gas has been discussed at many of the meetings of the different societies of gas engineers. A paper was read on this subject in November, 1890, by Mr. Frank Livesey, before the Southern District Association of Gas Engineers and Managers, which treated of the same process as is described in this paper, and to which reference will be made.* The process is the introduction of the vapour of carburine—a light petroleum spirit of a specific gravity of ·680—by drawing a small portion of the gas to be enriched from the main, and after mixing the vapour therewith, forcing this rich gas so produced back into the main, thereby enriching the bulk.

The evaporator is in the form of a vertical tubular boiler, the tubes running between two plates, which latter are fixed at about 8 inches distance from the top and bottom of the casing. Steam is introduced between these plates and the outside of the tubes. The enriching material is pumped from the store-tank (which is placed underground) by a small steam-pump into the evaporator, at a point below the bottom plate, and is forced up inside the tubes; the effect being that the spirit is evaporated—thus forming a pressure of vapour, which is conducted, by a tube fixed above the top plate of the evaporator, to a regulating-valve placed on an injector, which is connected to the gas-main containing the gas to be enriched, by small pipes at two points a short distance apart. The vapour under pressure is allowed to pass through the regulating-valve into the injector, forming a partial vacuum at the top of it, to which one of the small gas-pipes is connected. The effect is that the coal gas is drawn into the injector, where it mixes with the hot vapour, and forms a very rich gas, which is then driven through the second connection back into the gas-main, to mix with the bulk of gas at a point nearer to the gasholder or the consumer. The quantity of vapour is easily regulated by the valve in the injector. If the pressure of vapour in the evaporator is increased on account of a smaller consumption, the effect will be that less spirit will be thrown by the pump. As the pressure acts on the delivery of the spirit, the level thereof is lowered; and the amount of evaporating surface is thereby reduced. In the case of an increased consumption of vapour, the action would be just the opposite. The apparatus is, therefore, practically automatic.

The carburetters have been doing practical work for the past two years, in many cases effecting all the enrichment without the use of cannel or other rich coal. The South Metropolitan Gas Company have these enrichers at all their stations. The Gaslight and Coke Company have had them at work at some of their principal works for two years past; and several more are now being fixed at their other stations. The gas enriched by this process is quite as permanent as that produced by the use of cannel coal. In one instance, in London, the official testing-station is upwards of eight miles from the point where the gas is enriched (sometimes to the extent of more than a million cubic feet per hour) 2 or 3 candles, and no loss in illuminating power takes place.

Mr. Frank Livesey, in the paper already referred to, said the cost of enriching coal gas one sperm candle, by the use of cannel coal, was 2·68d. per 1000 cubic feet; and by the use of spirit, it was 1¾d. per candle per 1000 cubic feet. The cost of the spirit was taken at 13½d. per gallon. The present price of carburine—a much more suitable material—is about three-fourths of this price; thus reducing Mr. Livesey's cost to about 1¼d. per candle per 1000 cubic feet.

The following are some extracts from Mr. Frank Livesey's paper:—

The important point to ascertain first of all was, Will gas, after being enriched, retain its quality? To test this, 430,000 cubic feet of gas were enriched to the extent of 2 candles, put into a gasholder, and left there for five days. Practically, no depreciation could be discovered. Another trial was then made, by testing the gas in a district main about a mile from the works. Two jet photometers having been rated to correspond exactly, one was placed at the works, and one at the point of trial. Here, again, the results were quite satisfactory; the gas, however, was enriched 1 candle only. It would have been more satisfactory had the distance been four miles instead of one. . . . . This, however, is not the only advantage, as the gasoline method is much more reliable and certain in its results; and by its means the quality can be adjusted with certainty to half a candle or less.

Cost of Making Gas in the Ordinary Manner per Ton of Coal.

Black coal, costing 13s. per ton = 10,000 cubic feet of 15·25 sperm candle gas.

Cannel coal, costing 42s. per ton = 12,000 cubic feet of 30 sperm candles.

To raise the quality 1 sperm candle, it would be necessary to use 7 per cent. of cannel coal.

Sperm Candles.		Cubic Feet.	
93 per cent. × 15·25 =	14·18	93 per cent. × 10,000 =	9,300
7 " × 30·00 =	2·10	7 " × 12,000 =	840
	16·28		10,140

Equal to 10,140 cubic feet of 16·28 sperm candle gas.

* See JOURNAL, Vol. LVI., p. 1041; also (for additional particulars as to the apparatus) Vol. LV., p. 66, and Vol. LVI., p. 242.

	s.	d.
93 per cent. of black coal, at 13s. per ton	12	1
7 „ of cannel coal, at £2 2s. per ton	2	11
	15	0
Less 93 per cent. of 12 cwt. of coke, at 8d.	7	6
	7	6

(Other residuals not taken; same in both cases.)

Equal to 7s. 4¾d. per 10,000 cubic feet of gas of 16·25 sperm candles, or 8·87d. per 1000.

	s.	d.
100 per cent. of black coal, at 13s. per ton	13	0
Less 100 per cent. of 12 cwt. of coke, at 8d.	8	0
	5	0

Equal to 5s. per 10,000 cubic feet of gas of 15·25 sperm candles, or 6d. per 1000 feet.

Cost of enriching by cannel coal per candle, 2·87d. per 1000 feet.

Cost of Making Gas Enriched by Carburine, per Ton of Coals.

Black coal, 13s. per ton = 10,000 cubic feet of 15·25 sperm candles.

Carburine, 9d. per gallon, 1¼ gallons = 100 cubic feet of 100 sperm candle gas.

To raise quality 1 sperm candle, it will be necessary to use 1¼ gallons of carburine.

Sperm Candles.		Cubic Feet.
100 p. ct. of 15·25	= 15·25	100 p. ct. × 10,000 = 10,000
1¼ gallons of carburine	= 1·00	1 p. ct. increase in bulk = 100
	16·25	10,100

Equal to 10,100 cubic feet of 16·25 sperm candle gas.

	s.	d.
100 per cent. of black coal, at 13s. per ton	13	0
1¼ gallons of carburine, at 9d. per gallon	0	11¼
	13	11¼
Less 100 per cent. of 12 cwt. of coke, at 8d.	8	0
	5	11¼

(Other residuals not taken; same in both cases.)

Equal to 5s. 10¼d. per 10,000 cubic feet of 16·25 sperm candle gas, or 7·05d. per 1000.

	s.	d.
100 per cent. of black coal, at 13s. per ton	13	0
Less 100 per cent. of 12 cwt. of coke, at 8d.	8	0
	5	0

Equal to 5s. per 10,000 cubic feet of 15·25 sperm candle gas, or 6d. per 1000 feet.

Cost of enriching by carburine per candle, equal to 1·05d. per 1000 feet.

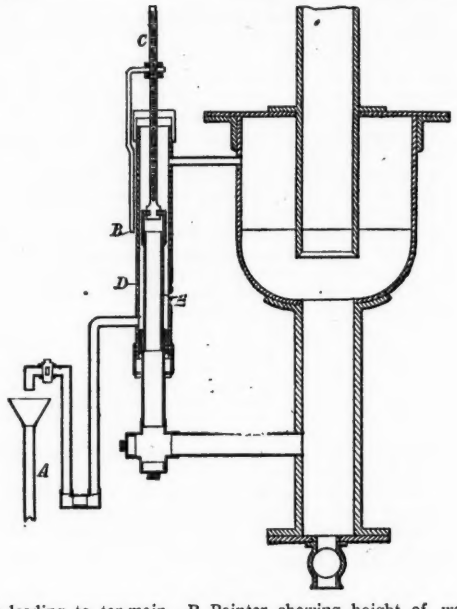
Besides showing a saving of upwards of 1¾d. per candle per 1000 cubic feet of gas made, there are other great advantages in using the Gas Lighting Improvement Company's patent process of carburetting. They are: (1) More gas per ton of coal can be made, on account of being able to work the retorts at higher and more regular heats; also a level gauge can be kept on the retorts. (2) More gas per retort; therefore less cost for labour, wear and tear, capital outlay, &c. (3) The quality of the coke is not deteriorated, as is the case when using cannel coal. (4) Possibility of immediately increasing the illuminating power of the gas to any desired degree, either on the inlet to the gas-holder, or on the outlet mains to the consumers, either on the works or in the district. (5) The illuminating power of the gas can thus be regulated exactly to the quality required; thereby saving the cost of the extra quality usually put into the gas, so as to make sure of it going out to the consumer not under the proper illuminating power. (6) Saving in the cost of purification, enabling engineers to oxidize the purifying material as much as necessary. (7) The process also prevents to a very large extent the deposition of naphthalene in the mains and service pipes; carburine being a solvent for naphthalene. (8) Having the power of enriching at hand, in many cases a much cheaper coal can be used, or (what is also an important matter) a better coke-making coal.

Coal in Suffolk.—Dr. J. E. Taylor, of Ipswich, and other well-known geologists, are firmly of opinion that coal is to be found in Suffolk; and the trial boring which is being made at Culford, near Bury St. Edmunds, is watched with the greatest interest. Earl Cadogan is keenly alive to the importance of continuing the boring; and he has promised so much of his help to the geologists who have taken up the subject, that, if coal seams really exist at a reasonable depth, there is no doubt they will be reached.

The Use of Gas for Lighthouse Illumination.—At a meeting of the Science Section of the Royal Dublin Society last Wednesday, Mr. John R. Wigham exhibited a new lighthouse lens, which he called the "Giant," because it is of very much greater dimensions, and more than 50 per cent. greater focal distance, than any lens ever made. He read a short paper on the subject, in which he explained that the lens was constructed for him to meet the requirements of the flames of his large gas-burners, and that it had excited great interest as being likely to effect a revolution in lighthouse illumination. Each beam transmitted by the triform apparatus, of which this lens forms a part, measures 10 feet horizontally and 22½ feet vertically. It is considered that its light will, from its enormous volume as well as great intensity, be much more efficacious than an electric light of the highest power, assisted by the most suitable dioptric apparatus; and it is expected that, in fog dense enough to obscure the electric light, this new luminary will be able to make itself visible,

ELLERY'S SEAL REGULATOR FOR HYDRAULIC MAINS.

In the JOURNAL for the 22nd ult. (p. 540), Mr. C. Stafford Ellery, Engineer and Manager of the Bath Gas Company, referred to an arrangement for regulating the seal in, and drawing the tar from, hydraulic mains, which he had devised and adopted in his works. He claimed that it was similar to that patented by Mr. G. R. Hislop, of Paisley, which was described and illustrated in the JOURNAL for the 8th ult.; and we have since received from him, in support of his statement, a sketch of the appliance, from which the accompanying diagram has been prepared.



A, Pipe leading to tar-main. B, Pointer showing height of water-line C, ¼-inch Whitworth thread, screwed the whole length of the rod. D, 3-inch wrought-iron tube. E, 1½-inch wrought-iron turned tube. F, 2-inch wrought-iron tube.

Mr. Ellery thinks the general similarity of his arrangement to that of Mr. Hislop will be apparent, but it will be chiefly so in the following details: (1) The bored piston and regulator which regulates the seal, or, by lowering, empties the hydraulic main. (2) The manner of connecting the arrangement to the hydraulic main with top and bottom connections. (3) The method of actuating the regulator by means of a rod, screwed, and passing through the cover of the vessel. (4) The pointer and scale showing the exact water-line. It may be added that the appliance is made of ordinary gas tube and fittings; it is not patented; and it may be fitted up by any intelligent workman at small cost. The only casting required is the syphon bolted to the under side of the hydraulic main.

Death of Ex-Bailie Wilson.—The death is announced as having taken place recently at Pollokshields, of ex-Bailie William Wilson, who was for 25 years a member of the Glasgow Town Council, and also for a long time Convener of the Corporation Water Committee. Mr. Wilson was one of the leaders in the movement for the present extension works. He retired from the Council in November last, on account of failing health.

The Standards of Weight and Measure.—In view of the interesting event which took place at the Houses of Parliament on the 2nd inst.—when Mr. H. J. Chaney, the Superintendent of the Standards Department of the Board of Trade, tested the yard measure and pound weight in use in his department by the standards placed twenty years ago in a mural chamber on the staircase leading from the central hall to the committee-rooms—the "Descriptive List of Standards of Weight and Measure deposited with the Board of Trade, and of the Instrumental Equipment of the Standards Office," which has been issued as a parliamentary paper, claims more than ordinary attention. The Imperial standards of weight and measure now in use are: (1) Primary standards; (2) secondary, or Board of Trade standards; and (3) auxiliary standards. The account of the historical standards is full of general interest; but our readers will probably be more concerned with the description of the gas-measuring instruments, and the apparatus employed in connection therewith. The paper may therefore be commended to their notice. At the close of the ceremony above mentioned, which took place in the presence of the President of the Board of Trade (Sir Michael Hicks-Beach), several of his officials, the Speaker, and a numerous assembly, Mr. Chaney declared that the standards were to all intents and purposes unaltered. The test standards were then replaced in the chamber, which was duly sealed; and it will remain so till the time comes round for again calling its contents into requisition.

REGISTER OF PATENTS.

Manufacture of Gas.—Bourgoin, N., and Decorce, H., of Paris, No. 578; Jan. 12, 1891.

The apparatus proposed to be employed in the making of "lighting, heating, and motive-power gas," according to this invention, is shown in the engravings; fig. 1 being an apparatus without a condenser, and fig. 2 one with a condenser.

Fig. 1.

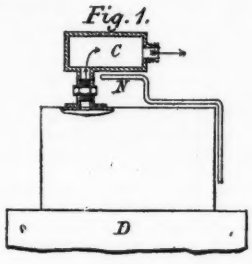
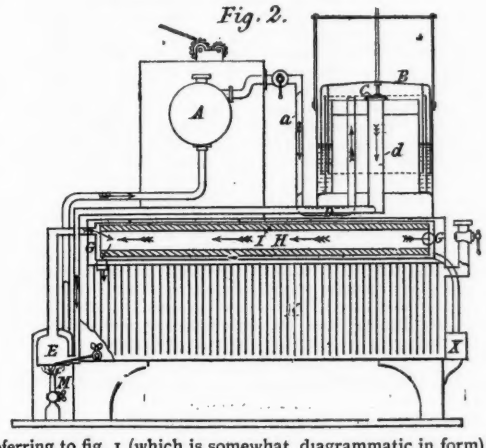


Fig. 2.



Referring to fig. 1 (which is somewhat diagrammatic in form), A indicates the position occupied by a pump which drives air into the retort C, which retort is heated by the gas-burner N. From the retort, the air passes into a pressure-regulator—not represented in the diagram, as it is identical with the pressure-regulator B shown in fig. 2, and hereafter described. In this regulator, the air expands, and as it mixes with a large volume of air contained therein, its temperature is reduced before passing into a carburetter D, arranged as will be described with reference to fig. 2. This arrangement, it is claimed, avoids all accidents; "in fact, if the air, for any reason, were to remain for a long time in the retort, it might be raised to a high temperature, and if in that state it were caused to penetrate directly into the carburetter, an accident would be likely to occur." But, say the patentees, by causing it to pass under a regulator, it can only reach the carburetter after it has mixed with the large volume of air already accumulated therein, which would immediately lower its temperature.

In the arrangement shown in fig. 2, the apparatus consists of a rotary pump A, operated by a weight or by other means; a pressure-regulator B; a retort E; a condenser G; and a reservoir K, separated from the condenser by an air-tight partition. The condenser G, which occupies the upper part, is formed of a series of tubes H, arranged in any suitable manner, and furnished internally with wire-gauze linings I, covered with cotton or other absorbent material. In the reservoir K are arranged sheets of metallic gauze, also surrounded with absorbent material, and so disposed as to afford the greatest evaporating surface.

The air to be carburetted is driven by the pump A into the pressure-regulator B. This is composed of a double-walled bell, which dips into two corresponding cylinders placed vertically, and open at the top. The air coming in from the pump, enters the bell by the pipe *a*, and lifts the cover or valve C by means of a rod, and allows air to pass in regulated quantities through the pipe *d* to the retort E. This retort is heated by the gas-jet M; and the air, which may be raised to a high degree of heat, enters the tubes H. The excess of vapour is now condensed; some of the liquid passing to the reservoir K, and from thence to the retort E. The saturated air from the condenser also enters the reservoir K, and after circulating around the vaporizing plates, passes either to the burners or to a holder.

In order to facilitate the saturation of the air, the heavier parts of the carburetting liquid are caused to fall drop by drop into the retort, when they are instantly volatilized, and mix with the air in the condenser. The air thus saturated, before going to the burners, circulates round the vaporizing sheets, and thus becomes completely saturated, mingling with the more volatile vapours given off from the sheets.

The advantage of this process of carburation (according to the inventors) consists (1) in rendering to the carburetting system all the heat absorbed by evaporation; and (2) to assure the continued and regular working of the apparatus, by avoiding the accumulation of the heavy parts of the carburetting liquid in the reservoir K. These heavy parts are, in effect, volatilized in the retort as fast as they deposit; and are thus caused to enter into the general circulation. Thus the richness of the gas remains the same; the saturation of the air always taking place at the same temperature.

A special reservoir is sometimes provided, into which the heavy products may pass, and which products, not being suitable to be drawn into the gaseous current, collect at the bottom of the condenser. This special reservoir is placed below the reservoir K, as at X (fig. 2), and it is connected with the condenser G by a pipe. On the other hand, in order that the flame shall maintain always the same heating and luminous intensity, the apparatus is suitably arranged for the purpose of constantly restoring the heat lost by the fact of the evaporation of the carburetting liquid. This end is obtained either by previously warming the air in a retort, or the air may be drawn by the pump through an envelope surrounding the gas-burner, and by thus tapping all the air that passes to the burner, none of the heat is lost.

Banding on Leathers for Dry Gas-Meters.—Shears, R., of Pentonville. No. 4846; March 18, 1891.

The patentee proposes to employ either a half round or soft round wire, rolled the proper substance and width, leaving the two ends round, which are intended to be drawn tight by twisting. The inventor claims the right to turn an eye on each end; and link on a short piece of wire, and tighten in the same manner. The leathers in a dry gas-meter are fastened on two tin rims. They are drawn on the rims by a string with a slip knot in the usual way; and the band, with the ends turned up about ¼ inch, is then passed round the leather and twisted till tight.

Gas-Engines.—Barclay, A., of Kilmarnock, N.B. No. 6578; April 16, 1891.

The nature and novelty of these improvements, consist in making the cylinder of a gas-engine closed at both ends and double acting—that is, to have a supply and explosion of gas and air at each end of the cylinder and act on the piston both on its in and out stroke, each revolution of the crank. The engines may be made with single, double, or triple cylinders, with the pistons acting on the same crank at different angles during the revolution, or on cranks set at different angles on the same or coupled crank-shafts, so that no two of them may be on the dead centres at the same time.

A further improvement consists in having a double-acting suction and compressing air and gas pump, for forcing the gas and air of the proper explosive proportions into each cylinder at the opposite ends, and of a proper density or compression for explosion. This is effected immediately after the piston has expelled the waste gases of the previous stroke, and has turned the extreme end of its stroke on its forward motion, and when the crank and piston have approached their best acting position, leaving a proper space between the piston and the end of the cylinder for the explosive gases admitted to act. The one end of the pump acts as a forcing and suction pump to each end of the cylinder, so as to fill that space with the gases of a proper density. The piston of the pump would be actuated by a crank on the same crank-shaft, set at a certain angle behind the main crank of the piston of the cylinder, in order to effect the proper compression of the air and gas at the same time.

Another improvement consists in having separate inlet check-valves for the air and gas—two or more in number, for safety in preventing ignition or explosion back into the pumps—on the forcing-pipes of each pump, leading to a separate inlet-valve casing for each opposite end of the cylinder, and with quite separate exhaust-ports and passages leading from each valve casing; so that no direct action or connection can take place between the opposite ends of the cylinder or valve and ports, except from the separate air and gas pumps, or separate ends of the pumps. And, further, in having a separate valve—preferably a slide-valve—in each valve casing, for the admission of the compressed air and gas and the exhaustion or escape of the waste gases to and from the opposite ends of the cylinder.

A further improvement consists in working both valves in their separate casings by the same rods and levers or wiper shaft, from a single eccentric on the crank-shaft; and in so fitting the explosive slide blocks or equivalent valves with their igniting flame ports on ported face-plates at the extreme ends of the cylinder, that these also could be worked from one eccentric for the purpose on the crank-shaft through intermediate arrangements of rods and bell-cranks.

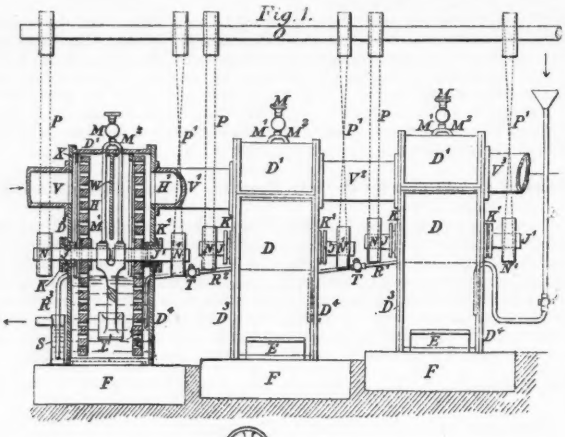
Extracting Tar and Ammonia from Gas.—Lister, A. A., of Peckham, S.E. No. 7092; April 24, 1891.

The washer constructed according to this invention consists of a circular drum or casing standing vertically. It contains two wooden perforated discs, nearly filling the interior of the casing, arranged to revolve in opposite directions. The washers are placed in series, in line one behind another on a foundation built in ascending steps. Clean water flows into the highest washer, and leaves it by an overflow syphon-pipe at about the centre; so that the casing is always about half full of water. It then flows to the next washer, and so on in succession; emerging from the lowest one of the series, charged with the tar and ammonia removed from the gas. The gas flows through the washers in the reverse direction; entering at the lowest one, and leaving at the highest. The perforated wooden discs carry up the water; and, by reason of their revolving in contrary directions in each casing, cause the gas to thoroughly mix with the water, and so remove the tar and ammonia. Each disc is mounted on a short horizontal shaft entering the side of the casing; the inner ends of the shafts being supported in bearings carried on a central standard or cross-bar. A pulley is fitted on the outer end of each shaft; and a series of pulleys to correspond is fixed on an overhead shaft—revolution of the discs in contrary directions being obtained by means of open and crossed belts.

Referring to the illustrations on the next page, fig. 1 is a side elevation of a series of washers; the first one being shown in section. Fig. 2 is an end elevation of a washer; and fig. 3, a cross section.

Each washer consists of a circular metal drum or casing, formed for convenience of opening in three or more pieces D D^1 D^2, united by bolts through their flanges, and with ends closed by circular covers D_3 D_4, bolted on through the flanges. The casing rests upon supports E E^1 bolted to the foundation F. H H^1 are wooden perforated discs nearly fitting the interior of the casing; and each mounted on short horizontal shafts J J^1, passing through and working in stuffing-boxes K K^1 in the covers—their inner ends being journalled in bearings carried by the standard L. M is a lubricator communicating with the bearings by the pipes M^1 M^2. Pulleys N N^1 are fitted on the shafts J J^1; the pulley N being driven by an open belt P, and the

Fig. 1.



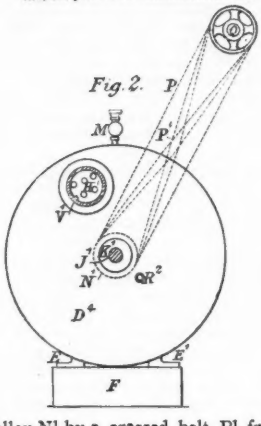


Fig. 2.

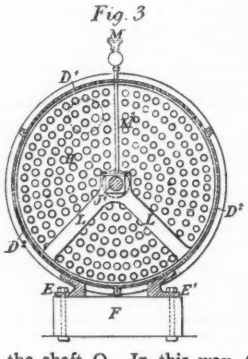


Fig. 3.

pulley N^1 by a crossed belt P^1 from the shaft Q. In this way, the discs H H^1 revolve in opposite directions. The washers are placed in line, one behind another; the foundations F being in ascending steps, so as to cause the water used for washing the gas to flow more readily through them. The water enters the highest washer through the pipe R; from thence it passes to the next washer through the overflow-pipe R^1; and to the next, by a similar pipe R^2. It leaves the last washer charged with tar and ammonia, by a pipe R_3, syphoned in a suitable overflow-vessel S. These pipes are all syphoned, to prevent the exit of gas through them; and they are so arranged that the level of water in each washer is maintained at a little below the centre. A regulating-tap T is provided in each pipe. The gas passes in the opposite direction to the water; entering the lowest washer through the pipe V, and passing from washer to washer through the connecting-pipes V^1 V^2 V_3. The perforated discs H H^1 carry up the water; and, by reason of their revolving in contrary directions, cause the gas to thoroughly mix with the water, and so to remove the tar and ammonia therefrom. The patentee proposes to sometimes place a partition W in the casing, so as to bring the gas more completely in contact with the wet perforations and surfaces of the discs. Strips X may also be fixed in the casing against the discs, to hinder the gas from passing over their edges. The discs H H^1 and their perforations are preferably left rough, in order more effectually to carry up the water.

Indicating the Presence of Gaseous Compounds in Rooms, &c.—Egger, B., of Vienna. No. 7846; May 6, 1891.

This invention relates to apparatus for indicating automatically (according to volume percentages), outside of a given space normally occupied by a gas or gases, the presence in or absence from such space of other or foreign gas or gases of different specific gravity from that of the usual gaseous contents of the space.

Fig. 1.

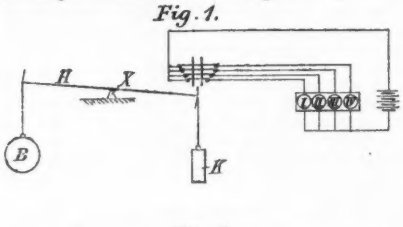
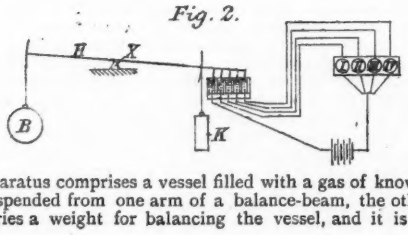


Fig. 2.



The apparatus comprises a vessel filled with a gas of known specific gravity suspended from one arm of a balance-beam, the other arm of which carries a weight for balancing the vessel, and it is connected with a suitable electrical contact device. The weights of the parts are so adjusted that the balance carrying the gas vessel will be in equilibrium when the apparatus is immersed in gas of the specific gravity of that normally occupying the space in which the apparatus is to be used. When gas of a specific gravity other than that of the gas enclosed in the vessel, enters the space in which the apparatus is located, or the gas passes out of the space or is displaced by another gas, the vessel will, as its buoyancy varies by the difference of the specific gravities, sink or rise according as a gas of less or of greater specific gravity surrounds the vessel. The consequent movement of the balance-beam will cause, by means of the contact device above referred to, the interruption, or the completion, as the case may be, of an electric circuit in which a signalling or indicating device situated at a suitable point is included. A series of contacts is provided, each of which is arranged to be operated by a predetermined difference of specific gravity; and thus the quantity of the foreign gas liable to enter the space in which the apparatus is placed will be indicated automatically according to percentages of volume.

Figs. 1 and 2 show diagrammatically two modes of construction of apparatus according to this invention.

A vessel B, filled with a gas of known specific gravity, is suspended from one arm of a very sensitive balance-beam H, pivoted at *x*. The other arm of the balance-beam carries a counterweight K, so that the balance is in equilibrium under normal conditions. Since the vessel B must not be sensitive to the pressure and temperature variations of the gas surrounding it, and in order that its volume may vary according to the tension of the gas, and that there may always be the same pressure within and outside the vessel, a portion of or the entire vessel (which may in other respects be of any suitable form) is made advantageously of flexible material. The right arm of the balance-beam H is arranged to act upon a contact device included in the circuit of a suitable signalling or indicating device. This contact device consisting either, as shown in fig. 1, of a series of contact plates which are raised successively corresponding with the percentages of volume of the gas entering the space; or there is provided, as shown in fig. 2, an extension of the right arm, furnished with a series of contact pieces of different lengths, each of which dips into a cup filled with mercury or other suitable conducting liquid. These contact pieces are lifted out of the cups in succession as the arm rises, according to the increase in the percentages of volume of the foreign gas of less specific weight entering the space. By the removal of the contact pieces from their respective cups, the circuits connected therewith are broken, and the signalling or indicating appliances connected therewith are successively set in operation.

Prepayment Gas-Meters.—Cowan, W., of Edinburgh. No. 8444; May 16, 1891.

This invention in prepayment gas-meters (either wet or dry) consists of improvements in, modifications of, and additions to two previous inventions by the same patentee—No. 11,537 of 1890, and No. 3575 of 1891. An illustrated description of the latter appeared in the JOURNAL for March 29, p. 577; the former, in the JOURNAL for Sept. 8 last, p. 445.

The present invention provides, first, improved means for giving the necessary friction to the slip driving-wheel of the prepayment wheel and pointer shaft. Secondly, an improved form of pusher, whereby the fraud known as "pumping" (that is, moving the handle slightly backwards, and so gearing and ungearing the pawl into the prepayment wheel, which, by this operation, would enable the consumer to obtain more gas than the value of the coin) is prevented, and other advantages are secured. Thirdly, an improved compound "stop" arrangement, whereby the same stop answers the double purpose of bringing the mechanism of the meter to a stand (and so shutting off the supply of gas), if the pusher be not returned to its normal position, and also when the quantity of gas paid for has been supplied. Fourthly, an improved prepayment wheel and pawl arrangement, which enables the teeth of the prepayment wheel mechanism to be made as coarse as may be found necessary for secure working, and so lessen the tendency to "miss" which might be experienced when very finely-cut teeth are employed.

Fig. 1.

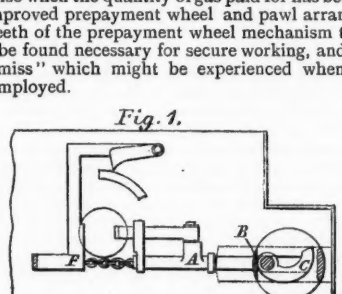


Fig. 2.

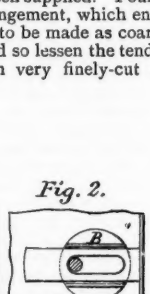


Fig. 3.

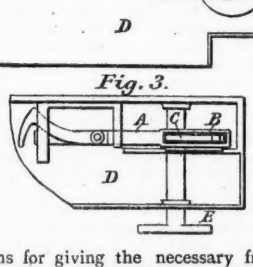
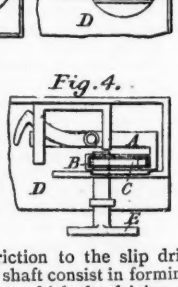


Fig. 4.



The means for giving the necessary friction to the slip driving-wheel of the prepayment wheel and pointer shaft consist in forming the shaft with a ground tapered plug or key, over which the driving-wheel is placed; the boss of the wheel being provided with a correspondingly tapered hole or barrel, and the two sufficiently bound together by a nut or nuts, screwed on to the shaft. Or the ground plug or key may be formed on the outside of the driving-wheel's boss, and the tapered hole or barrel on the one end of the shaft, or on the boss of the pawl-actuated wheel or of the grooved valve lever operating wheel. Which-ever plan be adopted, the plug or key and the hole or barrel would be

bound together by means of a nut or nuts; thus providing an arrangement which, while allowing the index to drive the prepayment shaft and its connections, at the same time allows or leaves the shaft free to be revolved independently without actuating the index.

The improved form of pusher is shown in part elevations (figs. 1 and 2) and part plans (figs. 3 and 4). The pushing-bar A is provided with an eccentric box or track B, which may be in line with, or lie alongside, the bar. Inside this box or track is mounted an eccentric or cam-shaped lever C, which is keyed or otherwise secured to a cross-shaft carried by guides or brackets, and having its front end projecting through the front of the index-case D, where it is provided with a suitable knob or handle E. In order to operate the pawl bar F in a backward direction—that is, to replace it in its normal position—it is connected to the pushing-bar A by a chain or a one-way actuating slip rod; thus dispensing with the use of springs as heretofore, as well as of the stationary rack, pawl, and mercurial tumbler.

In using the foregoing with meters like those described in patent No. 3575 of 1891 (that is, in meters where the pawl is mounted on the front end of the coin slot-piece, tubular extension, or rods thereof, as before, so that on the pusher being operated it carries the coin, the coin slot-piece, and the pawl with it), the inventor proposes to proceed as

Fig. 5.

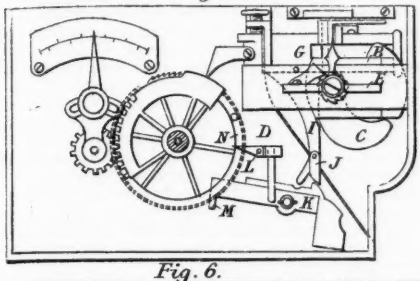
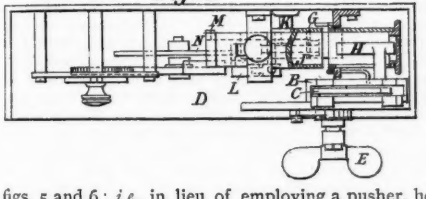


Fig. 6.



shown in figs. 5 and 6; *i.e.*, in lieu of employing a pusher, he uses an eccentrically, actuated device, preferably formed by mounting alongside the slot-piece G an eccentric box or track B, which works longitudinally in one or more guides. Inside this box or track is mounted an eccentric or cam-shaped lever C, which is secured to a cross-shaft carried by guides or brackets, provided with a knob or handle at its outer end, as already described. The eccentric box or track has a projecting stud or pusher H formed on or attached to the side next to the slot-piece, which is provided with a longitudinal slot or opening on its side or extension, so as to enable the stud or pusher to work in and so grip the coin.

The compound "stop" arrangement (as shown in these illustrations) is obtained by providing the slot-piece G with a lower arm or tail piece I, which is provided near its lower end with an auxiliary pivoted arm or tail piece J, both of which have their lower ends working on a suitably-shaped track, provided on the top side of a pivoted lever K, which has one end weighted, and its other bent in such a manner as to engage with the point of the ordinary tangent of the dry meter. The object of this pivoted tail-piece is to force down the weighted end of the pivoted lever, in the event of the weight being inadequate to take the stop end M out of the position in which it obstructs the progress of the tangent or other part of the meter's mechanism. The tail-piece J only yields in one direction—that is, when it is going inwards with the pusher; but it is rigid on the backward journey when it meets with a rib or wall on the upper surface of the pivoted lever K, against which it presses and forces the lever down and so removes the stop. The lever K is also provided with a bent upright rod or bracket, which has mounted at its top end a one-way yielding arm or projection L, which may be jointed on or hinged thereto, and against which a stop or projection on the pawl-actuated wheel N works, and so causes the bent end of the lever to fall into the track of the meter's tangent, and thereby shut off the supply of gas. This forms a compound "stop" arrangement, which answers the double purpose of bringing the meter's mechanism to a stand if the pusher be not returned to its normal position, and also when the quantity of gas paid for has been supplied.

Gas Motor Engines.—Abel, C. D.; communicated from the Gas Motoren Fabrik Deutz, of Köln-Deutz, Germany. No. 8469; May 16, 1891.

This invention relates to four-stroke-cycle gas motor engines, so operated as to obtain, during the working stroke, any desired degree of expansion of the hot combustion gases, whereby a considerable economy in the expenditure of gas is claimed to be effected. At the same time, the arrangement is such that the premature firing of the combustible charges while they are being drawn in—which frequently occurs in four-stroke-cycle gas motor engines of the present mode of construction—and the consequent violent explosions, is entirely obviated. Lastly, the arrangement admits of the easy starting of the engine from a state of rest.

The arrangement and mode of operation consists essentially in drawing in a charge of air alone, through an air-inlet valve, during the suction stroke, so that no explosive mixture is at that time introduced into the cylinder; while during the following compression stroke, part of the air drawn in (which mixes with the residue of combustion gases remaining in the cylinder) is driven out of the cylinder again during the first part of such stroke—the remainder of the charge being then compressed during the completion of the stroke. At the same time combustible gas is injected into the charge of mixed air and combustion gases, so as to form an explosive mixture. The explosive charge thus produced, being in a compressed condition at the end of the instroke, is then ignited in any suitable way. On the following working stroke of the engine, there will consequently occur an increased expansive action of the hot combustion gases on the piston; the degree of expansion being the greater, the greater the volume of air and combustion residues expelled from the cylinder during the previous compression stroke. On the completion of the working stroke, the combustion gases are expelled from the cylinder by the following expelling stroke in the usual manner, thus completing the four-stroke-cycle.

Manufacture of Ammonia and Tar from Nitrogenous Organic Substances.—Thompson, W. P.; communicated from Dr. P. Kuntze, of Aschersleben, Germany. No. 9052; May 28, 1891.

This invention relates to the manufacture of ammonia and tar from nitrogenous organic substances, whereby, as a source of nitrogen, the extensive turf moors and peat bogs are principally thought of. The treatment referred to consists (*a*) in subjecting the broken up and dried material to charring in a furnace, heated by producer gases, generated at a later stage of the process, while the resulting mixture of tarry, aqueous, and nitrogenous vapours is submitted to an igniting process, for decomposing the organic nitrogenous vapours, in the presence of superheated steam and great surfaces of light red-hot porous refractory matter, into ammonia and hydrocarbons, which are separated and absorbed in any well-known manner; and (*b*) treating the residue from the charring process in a generator situated below the charring furnace, by means of hot air and superheated steam, in order to liberate the fixed nitrogen and convert it into ammonia; the resulting mixture of ammonia and permanent gases being separated in any well-known manner, and the gases applied for heating purposes.

Gas-Engines.—Leigh, H. H., communicated from P. F. Forest and G. Gallice, of Paris. No. 22,559; Dec. 24, 1891.

This invention has for its object to provide for the complete utilization of the gaseous products of combustion before they are expelled from the cylinder.

The indicator-diagrams taken on engines made according to the present invention, the patentees remark, show that the exhaust has a pressure varying between three and four atmospheres. This represents a considerable loss of energy—due firstly to the pressure not used, and secondly to the power used to expel the exhaust. To remedy this drawback, it would be necessary to make the stroke of the piston long enough to allow the gases to expand to atmospheric pressure. But it would also be necessary for the charge of gas and air to remain in the cylinder the same time. Now, if the piston stroke is lengthened, the volume of the charge is increased accordingly, and the final result will be exactly the same. What is therefore required is to be able to increase the piston-stroke during the expansion period—keeping it as before during the charging and compression periods; or, what comes to the same thing, to reduce the stroke during the charging period, keeping it as before during the expansion period, or in a word to reduce the charge, keeping the other matters as previously. This being arranged for, and it being borne in mind that in four-cylinder engines one of the pistons always begins to draw in a charge while another of them commences to compress, this invention in its widest sense relates to the returning into the former cylinder a portion of the compressed charge.

The specification describes the application of the invention to a reversing Pilon engine with electric ignition; but it is distinctly stated that this is only one example, and that it is equally applicable to any type of four-cylinder engine.

The invention acts in the following manner: The first cylinder having finished its feeding stroke, and the third cylinder beginning its stroke, the first lever operated by the cam swings on its fulcrum and presses upon the spindle of the valve, which it keeps open for a determinate time. During this latter the return stroke of the piston drives the charge past the valve into a pipe, from which it is drawn into the third cylinder. This latter in its turn sends a portion of the contents into the second cylinder, which in its turn delivers into the fourth cylinder, and so on. The volume returned is adjusted so that the exhaust shall be at atmospheric pressure. Such a construction is equally adapted for the purpose of utilizing the exhaust in slow-speed engines; in fact, with such engines the exhaust takes place at half-stroke, with a corresponding loss. But, according to this invention, the energy lost is, instead, led into the next cylinder, and a corresponding economy effected.

APPLICATIONS FOR LETTERS PATENT.

6655.—Morani, F., "Gas motors." April 6.

6733.—Rylands, D., "Utilizing gas for warming or heating purposes." April 8.

6783.—Howlden, E. F., "Controlling the gas supply from reservoirs to burners on railway trains." April 8.

6877.—Woodward, J., "Charging gas-retorts." April 9.

6908.—Collet, H., and Merichenski, M., "Mixture intended for use in carburetting air or enriching combustible gas." April 11.

6909.—Collet, H. and Merichenski, M., "Carburettors." April 11.

6917.—Simons, F. A. A., "Prolonging the durability of incandescent gas-lamps." April 11.

6952.—Dawson, H. T., "Gas-engines." April 11.

6989.—M'Mullen, J. A., "Conduits applicable for combined use as casings for electrical conductors and for gas supply, or for either use separately." April 12.

7079.—Collins, C. R., "Gas-making apparatus." April 12.

7167.—Donnelly, J., "Gas welding appliances." April 13.

7210.—Lewis, J., "Gas-valve for blast-furnace regenerative stoves, applicable also to gas-fired boilers." April 14.

7310.—Fletcher, A. T., "Automatic extinction of gas-lights." April 16.

7320.—Southall, J., "Gas and oil motor engines." April 16.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

The Minimum Size of Water-Mains and the Laying of Mains, Hydrants, &c., for the Protection of Property from Fire.

SIR,—Although little new may be advanced on the above subjects, yet by directing attention to them, it may be possible to draw from those who are at present engaged in the work expressions of views that may lead to practical conclusions not before noted in the JOURNAL.

A town may possess a water-works, but this is not always a proof that it has the capability of giving ample protection during a great conflagration; therefore it behoves the proprietors of such works to provide pipes and hydrants of sufficient diameter to allow a large margin for accidents. A pressure of 80 to 100 lbs. per square inch is a far more preferable safeguard than a good equipment of fire-engines. Having secured for the erection of the reservoirs the highest elevation in the district that will give the maximum pressure necessary to cope with the largest fire that may probably take place, care must be taken to make the outlets from them of sufficient size to provide for the future increase of the population, manufactories, &c. These pipes may be reduced at a suitable distance outside the reservoir grounds; and when the requirements of the town demand it, larger mains can readily be attached to the outlet-pipes.

A good topographical map, on a large scale, of the mains to be laid down in all the streets is of the first importance, as this graphic manner of showing the difficulties to be overcome will prove most advantageous and economical. The scale should be large enough to show all the bends, angles, and connections, main cocks, hydrants, and large meter supplies.

In laying out a new water-works, the first consideration is the present needs of the town for all purposes, and not least is that of a full supply for the protection of property from fire at a maximum pressure. This will refer first of all to the main carriers from the reservoirs; but still greater discrimination is required in laying out the distributing-mains through every street, which shall command all the by-ways, courts, and alleys. An estimate must also be made of the probable extension of the town, and its many requirements, for sanitary and manufacturing purposes; not forgetting that the greatest proportion of the water will be used in from eight to nine hours. These points are too often sadly insufficiently considered. When we look at the growth of towns as shown by the last census, it must be obvious to everyone that the small pipes which are still being laid must in the near future be duplicated or larger mains substituted. The maximum calculated rate of consumption must be added to the probable quantity that may be required at an extensive conflagration; and the whole of the mains should be large enough to cope with such an emergency.

Some engineers have estimated the required quantity of water for extinguishing fires at 1-12th of a gallon per head per day. Although this quantity seems small in comparison with the other uses for water in a town, yet it proves that, in order to be properly provided with mains of a sufficient size, the capacity must exceed the requirements for the remaining consumption. Fanning states a case as follows:—

> Take 1200 feet of distribution-pipe in a closely built-up section. We find on the 1200 feet length (say) 40 domestic service-pipes, and consumption of (say) 750 gallons each per day = 30,000 gallons per day. Making due allowance of 50 per cent. increase of flow at certain hours, we have a required delivery capacity of 1·5 cubic feet per minute to cover this whole consumption. On the same 1200 feet of pipe, there are (say) four fire hydrants. If, in case of fire, we take from these hydrants only four streams in all of 20 cubic feet per minute each, we require a delivering capacity of 80 cubic feet per minute. In this case, which is not uncommon, the required capacity for fire service is to that for the remaining service as 80 : 1·5. If the given pipe 1200 feet long is a 6-inch pipe, supplied at both ends, then the delivery for fire at each end is 40 cubic feet per minute. If the 80 cubic feet per minute must all come from one end of the pipe, then the pipe should be 8 inches in diameter.

Although somewhat of a digression, it is well to state that, seeing there is a considerable increase in the cost of all the plant required, principally because of the pressure and the increased quantity of water demanded on a sudden outbreak of fire, and the sizes of mains having to be augmented, it is only reasonable that the people who are thus protected should pay for the use of the hydrants the repairs thereof. These large numbers of main-cocks, hydrants, and fittings, would not be required but for protection from fire; and if the law enacts that water shall be supplied gratis for this purpose, the expense and maintenance of the apparatus should be borne by the public. This is not now the case in several towns. It must always be remembered that four-fifths of the fires are extinguished by the pressure in the mains before the fire-engines arrive.

Take an instance of a big warehouse, hotel, or large school. A 4-inch fire-main is usually run into the building, and carried up the centre to the second or third floor, with hydrants on each floor. This pipe may be connected to a 4-inch or 5-inch main in the street. On the arrival of the fire-engines, it is found that the hydrants on the main in the building are taking most of the water, and that there is not sufficient to supply the engines. In the excitement, a fireman has attached his hose to a hydrant near the building; and no one has sufficient pressure to carry a jet any distance to be of service. Suppose there are in the same street a lift or two, or a manufactory using water, what chance is there for the firemen to extinguish a large fire? I recently read of a case where a house was on fire and two engines came up readily enough. The main was only a 4-inch one, and of considerable length. Both firemen attached their hose, and, of course, they had not sufficient pressure. As neither fireman would give way, the house was, in consequence, completely destroyed. One hose carrying a full pressure would have been sufficient to save the property in this instance. The use of 4-inch pipes in towns should be condemned as too small. A short length of 4-inch pipe may, while new, give a moderate supply to two short lengths of hose under a pressure of 100 lbs to the square inch; but often the 4-inch main is corroded greatly, and it is not equal to a 3-inch one. The friction in the hose alone is really enormous. With a discharge of 150 gallons per minute, it absorbs 3 inches of head for every foot of the hose.

Where an efficient service for extinguishing fires is required, a 6-inch main is necessary; and this size must be restricted to a certain length in accordance with the class of property to be protected. Of course, the length of the main and the pressure at hand have to be fully considered. It must be borne in mind that, even in moderate-sized towns, two and three fires may occur at one time; and there are usually four or five jets called into requisition at each fire. Although the pipes may not have to withstand a pressure of more than 40 lbs. per square inch in the usual way of working, yet with the increased heights of buildings and the use of numerous lifts, an augmented pressure will ultimately have to be maintained. It is therefore desirable always to put in pipes tested to four times the pressure generally employed. In some soils the pipes quickly deteriorate, and become as soft as plumbago. The iron may then be cut with a knife. The question of water-hammer must also be considered; as well as the constant demand for water for use in motors, street watering, flushing, &c.

In many towns there is a high and a low pressure service. The mains being so very small, they will not carry sufficient water at times to supply the population in the district. Recourse is then had to high-service supply to sustain the pressure; and this causes great expense, as every extra foot in height that water is raised entails a needless waste of fuel, when the low pressure would have been sufficient if the pipes had been large enough to supply the consumers and keep up the pressure. The constant charging of the mains at a higher pressure often leads to the bursting of the pipes; and when such an accident occurs during the progress of a fire, the situation is very serious, and must lead to distressing results. The fire brigades are constantly increasing the number of their engines and plant; and in a few years the sizes of pipes in many towns will have to be considerably enlarged to be in a position to supply them with water. There should be a better understanding between the brigades and the water companies, who supply the water gratis, as it often happens that the inspector or turncock would be of incalculable service, not only in pointing out the location of the hydrants, but in informing the chief fireman as to what quantity of water could be drawn from a certain district, having a small main which could not be known to them.

The number of fires constantly occurring, and the vast sums of money lost annually, are abundant proofs of the importance of the scientific study of the smallness of mains still being laid and of the present state of the whole of the distribution plant in regard to protection from fire. Proper hydrants open to the right hand; but some open to the left. Why the latter plan is adopted, I have never been able to satisfactorily ascertain. I have but one left-handed valve in the town with which I am connected; and, of course, each individual turncock will turn it the wrong way, although it is known to have a left-handed screw. There is sometimes a difficulty in finding the hydrants. I fix them with regularity at the corner of every street 3 feet from the curb-line, with the box placed in the footpath, and a white plate attached to the house opposite to it. I can always find them in the dark, or if covered with ice and snow. No matter how great may be the excitement at a fire, there is no time lost in finding the hydrants when they are placed in this manner.

Hose couplings do not always fit the hydrants, especially when they are supplied by more than one maker. Some will be just a little too tight; others are so loose that it is with difficulty they are kept on. It therefore becomes necessary that every hydrant should be accurately measured and tested before being fixed, and the standard mesh only accepted. There should be a sufficient number of blow-offs fixed underneath the mains, for emptying and scouring out; one being placed at every dead end. Hydrants are of little use for this purpose, as the top water only is blown out, and much of the sediment is left in the mains. It is necessary that the pipes should be first emptied, and then the full pressure turned on, as this will scour out all dirt through the bottom wash-out pipe. This is equally necessary to keep the pipes free from deposit and incrustation, so as to have the benefit of a *full-bore* pipe in case of fire, as well as for the purpose of giving a pure supply. A main-cock and hydrant placed at the corner of every street may be said to be a waste of money; but one never knows which may be required, or when. They are essential for shutting off each section of the street for repairs, and for testing and flushing; they may also, in case of a large fire, be used to concentrate all the pressure around the street where the fire is raging. The benefit of having these main-cocks may be exemplified at the very first conflagration; and they may prove to be of more value than the total number fixed. I am sure it will be found that the advantages will more than counterbalance the cost.

INSPECTOR.

April 22, 1892.

The Fourness Gas Process Syndicate, Limited.—This Company has been registered with a capital of £2000, in £50 shares, to carry into effect an agreement made between J. Barclay and W. V. Hamilton, H. Fourness, the several persons mentioned in the agreement, and the Company, for the acquisition of certain patents relating to improvements in the manufacture and storeage of illuminating and heating gas, and to develop and work them.

Sale of Shares.—At West Hartlepool last Wednesday, 500 shares of £10 each in the gas capital of the *Hartlepool Gas and Water Company*, on which the maximum dividend is 7 per cent., and also 172 £10 shares in the water capital, were disposed of by auction. Only £2 was to be paid up on the water shares; the remaining £8 to be called up as required. The prices realized for the gas shares ranged from £15 16s. to £16 17s.; and for the water shares, from £5 10s. to £5 16s. 6d.

Water-Works for Millbrook.—Mr. T. Codrington, C.E., one of the Local Government Board Inspectors, held an inquiry at Millbrook, near Plymouth, last Tuesday, concerning an application by the St. Germans Sanitary Authority for a loan of £6000 for works of sewerage and water supply. It was stated that it was proposed to obtain a supply from the Bridgemoor stream, and that a reservoir would be constructed capable of containing 54 days' supply, amounting to about 2 million gallons. The total cost of the scheme was estimated at £5150. At the conclusion of the inquiry, the Inspector visited the site of the reservoir.

FLETCHER, RUSSELL & Co., LIMITED,

Gas Engineers and Artistic Ironfounders.

The Amalgamated Firms of

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" 41, Tabernacle Street, E.C.

EXTRACT FROM REPORT OF G. W. GRIFFIN, CONSUL, SYDNEY, IN REPLY TO A NOTE FROM THE DEPARTMENT OF STATE, AND ISSUED FROM THE BUREAU OF STATISTICS, DEPARTMENT OF STATE, WASHINGTON D.C., U.S.A.

"For Heating purposes the Gas Stoves imported from England "of the make of Messrs. Thos. Fletcher & Co., Gas Engineers, "Warrington, seem to be most in favour. They afford a wide range in "pattern and price. There is an increasing demand for Fletcher's "Patent Indestructible Cooking Ranges."

THE ONLY OTHER ENGLISH MAKERS' APPLIANCES MENTIONED IN THE CONSUL'S REPORT WERE SEVERELY CRITICISED, AND COMPARED IN VERY UNFAVOURABLE TERMS WITH THOSE OF THOS. FLETCHER & Co. NO SALE EXISTED FOR AMERICAN-MADE GAS COOKING AND HEATING APPLIANCES IN AUSTRALASIA.

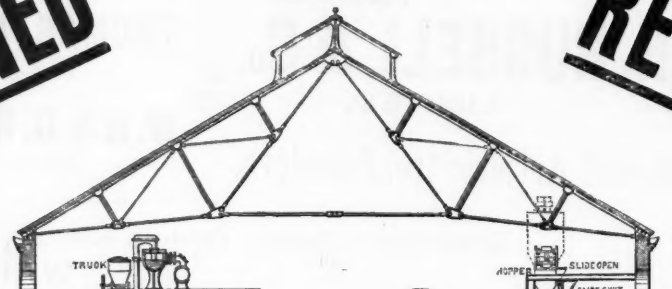
Telegraphic Addresses—"GASERIES," Warrington and London.

THE SYSTEM OF GAS

20,000 FEET INCLINED ERECTED RETORTS

GAS and CHEMICAL WORKS in ENGLAND where the System is in operation, or at present erecting, under the Company's Licence—

LONDON—
BECKTON.
BRENTFORD.
EAST GREENWICH.
KENSAL GREEN.
NINE ELMS.
PIMLICO.
SOUTHALL.
BIRKENHEAD.
BIRMINGHAM.



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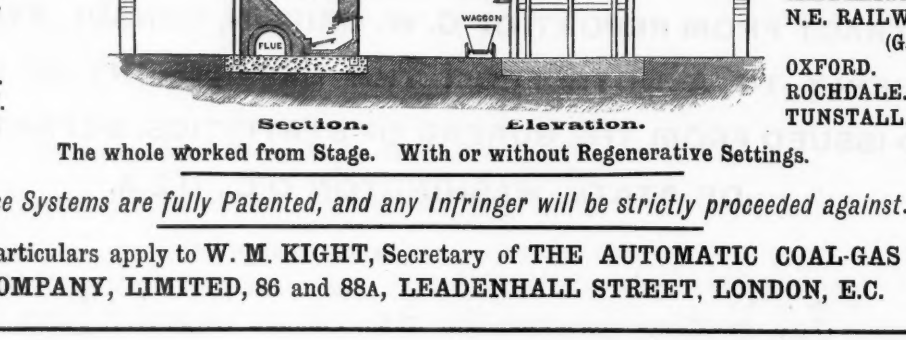

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PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS COMMITTEE.

Thursday, March 31.

(*Before Mr.* CAMPBELL-BANNERMAN, *Chairman; Sir* W. HOULDSWORTH, *Sir* H. STAFFORD NORTHCOTE, *Mr.* R. K. CAUSTON, *Mr.* S. GEDGE, *Mr.* P. STANHOPE, *Mr.* POWELL WILLIAMS, *Mr.* W. JAMES, *and Mr.* E. H. LLEWELLYN.)

BIRMINGHAM CORPORATION WATER BILL.

This Bill, by which the Corporation of Birmingham seek power to carry out a large scheme for furnishing a supply of water to the city from the Rivers Elan and Claerwen, in Radnorshire, came on the above-named day before a Select Committee constituted as set forth. The measure is being strongly opposed.

Mr. POPE, Q.C., Mr. BALFOUR BROWNE, Q.C., Mr. CRIPPS, Q.C., and Mr. G. A. R. FITZGERALD appeared for the promoters. The following Counsel represented parties opposing, or desiring to be heard against the Bill: Mr. PEMBER, Q.C., and Mr. FREEMAN, the London County Council; Mr. A. T. LAWRENCE, the Hereford Corporation; Mr. C. J. EDWARDS, owners of property in Birmingham; the HON. A. LYTTELTON, Mr. J. LLOYD, Mr. MOON, and Mr. R. L. WILLIAMS, various other petitioners whose interests are affected by the Bill.

Mr. POPE, in opening the case, said the Bill before the Committee was to enable an important Corporation to spend a considerable sum of money for the purpose of securing the present and future supply of water to a great industrial community. The first proposition on which he would submit evidence, and which he quite believed he would be able to substantiate in the most absolute manner, was that Birmingham was in immediate need of a further quantity of good water, and that this must come from some fresh sources. Until the year 1875, Birmingham was supplied with water by a Company, which was incorporated in 1826, and commenced business in 1831. In 1875, the Corporation were authorized to acquire the undertaking, and become the Water Authority. The Act which sanctioned this was amended in 1883 by an Act under which the area of distribution was increased to 82,221 acres; and a recent extension of the borough had further enlarged that area to 86,000 or 87,000 acres. Witnesses would place before the Committee detailed figures, showing that, in the three decades ending respectively in 1871, 1881, and 1891, the population of the area of distribution rose from 450,000 to 561,000 and 648,000; while the inhabited houses increased from 89,457 to 110,000 and 129,000. Birmingham was a community exceptionally situated as regarded its industrial interests. It was not dependent upon one large industry; it was a district of which the industries were so varied and so different that periods of depression very rarely affected them alike, or all at one time. On the whole, therefore, the progress of the city and its industry might be regarded as being pretty constant. The water supply had increased in proportion to the population. In 1876, the total supply of water within the area was 3031 million gallons a year; the daily average being 8,300,000 gallons, and the water-rental £93,527. In 1891 the consumption had risen to 6141 million gallons a year, or 17 million gallons a day; and the water-rental to £136,964. The present sources of supply were mainly two—rivers and sandstone wells. The rivers were the Perry and Witton streams, Plant's Brook, and the Rivers Blyth and Bourne. The Tame was one of the sources utilized by the old Company; but its increasing pollution led (in 1866) to the passing of an Act which provided for the gradual cessation of its use, and it had been abandoned since 1872. In the red sandstone formation there were six wells—at Aston, King's Vale, Short Heath, Perry, Selly Oak, and Longbridge. The minimum yield of all these sources together was about 17½ million gallons per day; and the average about 21 millions, or rather more. But for purposes of water supply to a large community, it was a dangerous thing to take averages as a guide to quantity, because it might be overtaken by periods of drought, when the average would no longer hold; so that the point of safety was, of course, the minimum. Scientific witnesses would tell the Committee that the demand in the year 1900 would certainly overtake any present possible supply—that was to say, that, in eight years' time, if in the meanwhile there was no period of drought, Birmingham would be at the end of her tether in this particular. He need not point out that such a state of things was not tolerable for a community of so much importance as Birmingham. Eight years! Supposing they were to obtain the sanction of Parliament to an immediate increase of the supply, wherever it was to come from, the preparation and construction of the works must at least occupy that period. This circumstance alone constituted one of the strongest cases he remembered for immediate legislation. In truth, no other community of this magnitude had ever been questioned as regarded its prudence, under such circumstances, in coming for immediate relief. Parliament, in dealing with Manchester in 1879, and with Liverpool in 1880, recognized to the full the duty of the Municipal Authority to ensure the supply of a necessity of life by an early application. Nothing was further from the truth than to say that Birmingham was now before Parliament in order to anticipate somebody else in the acquisition of a territory which it did not need. In fact, the Water Committee of the Corporation had had this question before them for several years past. They had not started it, as had been suggested, because the London County Council or any other body was looking for further supplies on account of the insufficiency of the Thames Valley; for it had been discussed and reported upon long before any such suggestion was made. Although he was far from saying that such a suggestion did not create a certain amount of alarm, lest the demands of the enormous interests and population of London might throw a weight into the scale which would prevent Birmingham from obtaining that which was absolutely necessary for their own existence, yet it was not the operating motive in the promotion of this Bill. Various suggestions were made as long ago as 1871 by Sir Robert Rawlinson; but lately, determined to act upon the best possible advice, the Water Committee of the Corporation passed a resolution by which they placed the question in the hands of Mr. James Mansergh, one of the most distinguished water engineers of the day. The present Bill was the result of his advice. It had received the approval of high authority besides, and the absolutely unanimous voice of the Birmingham City Council. With the exception, moreover, of a certain number, who, he could not help thinking, understood the question imperfectly, it was practically the demand of the people of Birmingham themselves. Mr. Mansergh's reasons, stated briefly, were these: The area of supply varied in level from 290 to 600 feet above Ordnance datum; and if water was to be supplied to the district by gravitation, a source must be sought of which the elevation was high. Of course, the distribution might be effected by pumping; but pumping was costly, and, for a large community, not a defensible method. As to the rate at which the consumption had increased, it had, during the early history of the supply, been abnormal, because, in the exercise of their duty, property-owners and others had been forced to abandon the use of wells which were thought to be unfit for public consumption. Although, therefore, the rate of increase had been 4¼ per cent., Mr. Mansergh took 3 per cent. as a measure of the future augmentation; and as time went on, he still further reduced it at the rate of ¼ per cent. every ten years. On this scale the quantity of water required per diem in 1915—*i.e.*, 25 years hence (a period always contemplated in the most limited calculation for water-works)—would be nearly 30 million gallons; and in 1940, it would be 51½ millions. The present supply would be exceeded in the former year by 9 million gallons a day; and in 50 years hence, by 33 millions. He had said that 25 years was always taken as a most moderate calculation. But, in dealing with all large communities, Parliament had hitherto acted with much greater wisdom, because it had foreseen that a hand-to-mouth policy—the policy of patching up an existing source of supply by the expenditure of capital which could only last over a few years, and which must ultimately be wasted—was not a prudent one. Hence, when Manchester and Liverpool went to Parliament, they received sanction to the acquisition of rights enabling them to cover a period of a couple of generations, within which time the capital they proposed to lay out might be supposed to be remunerative. Look, again, at Glasgow. Glasgow had become famous for the extent and excellence of its water supply. Would this have been possible if Parliament had, with a niggardly hand, prevented her from bringing water from Loch Katrine to an extent far in excess of what the people had before thought necessary? He owned that it seemed to him that one of the glories of the municipal government of Glasgow was that the supply of water was more plentiful and more unstinted than in any other community in the kingdom. In considering, then, how the future case of Birmingham should be met, Mr. Mansergh satisfied himself first of all that there were no local sources worthy of real consideration. No doubt it might be possible to construct upon the River Bourne four impounding reservoirs which should hold altogether 1100 million gallons, and yield about 7 million gallons a day. But if new powers were now being sought over that river, a part of the water which could be impounded would, of necessity, have to go in compensation to the streams, and the residue left for Birmingham would be so insignificant as not to be worth the capital expended upon it. The River Blythe was a larger stream, but one which was very unfavourable for the construction of storeage reservoirs. Moreover, the Bourne, the Blythe, and Plant's Brook together would only supply the wants of the district for some 15 or 20 years; and this, they thought, was not a sufficient time to provide for. But there was another, and it seemed to him, a fatal objection to the utilization of these streams. Dr. Frankland and Professor Dewar would tell the Committee what they thought of the probable future quality of the water these streams would yield. Birmingham had at present a healthy community; and even now it was not so because of the purity of the water. As far as the chemists were concerned, they would say, without hesitation: "If we were asked whether that is a suitable supply for a community such as Birmingham, we should condemn it." He did not mean to say that the existing impurities were such as to give rise to any alarm. But all these streams ran through highly-manured agricultural country, with many villages and farms; and before very long, public opinion would condemn water distributed from such a source. At all events, the expenditure of capital in increasing the supply from this source would be a financial operation of questionable wisdom. Of the wells, some were rather disappointing; but they furnished in the aggregate about 10 million gallons a day. Mr. Mansergh thought that, if it were desirable, within a reasonable distance of Birmingham five more could be sunk, which would yield very much the same quantity as the existing five. He would even go farther. He might almost admit that, if Birmingham had been a town with a present population of 250,000, growing but slowly, a well supply might have been considered. But the circumstances rather resembled those of Liverpool; and what was the experience of Liverpool with regard to such sources? For domestic uses, nobody had any fault to find with the Liverpool supply of well water in respect of its quality, though its quantity was variable. But that which had been found at Liverpool, and was now found at Birmingham, was that pumping from the red sandstone formation resulted in the gradual deterioration of the quality of the water, and remarkably so as regarded its hardness; so that at this moment the well water supplied to Birmingham had become so hard that it was absolutely unfit to be used alone for any trade or manufacturing purpose whatever. If, therefore, the supply must be by gravitation, Birmingham, standing on a higher level than any of the other large communities, was reduced to a more limited range of selection in looking out for gathering-grounds, because these must be correspondingly high. There were hundreds of thousands of acres of good ground which, in the event of the Thames Valley proving insufficient for the requirements of London, would be suitable for that community; but the number of spots which could be made available for Birmingham was very much smaller. If he rightly interpreted that utterance by Sir Thomas Martineau which had so much fluttered the Londoners, it had amounted simply to this—that the desire of Birmingham was not to take possession of ground available for the supply of London or of any other community, but that they should not themselves be anticipated in the acquisition of the only, or nearly the only land which was available for them, while there still remained for other communities the abundant area which might be utilized for their

purposes. Moreover, the request for delay by the London County Council was most unreasonable and most dangerous. They asked that the House should first have before it the report of the Royal Commission now sitting with reference to the London Water Supply. The suggestion was absurd. A year's postponement meant such a further delay that, if it was to be imposed upon Birmingham, the actual calamity would happen of that city being short of water. But what was the nature of the reference to the Royal Commission? The Commission would merely report whether, in their judgment, the Thames source was such as, in quantity and quality, could be made additionally available for the supply of the capital; but it did not lie within the scope of the Commission to recommend what area should be appropriated for London. How long would it take the London County Council to make up their mind where to go? Before they could act at all, they must come face to face with such difficulties as he was now discussing on behalf of the Birmingham Bill. They must go before a Special Committee of the House of Commons. So that, even if the report of the Commission were such as to satisfy the most ardent spirits of the County Council, and to condemn the Thames supply utterly, some years must elapse before the Council could make good their appropriation of any area. If the Elan and Claerwen valleys, to which Birmingham proposed to go, were chosen, they would not be sufficient in themselves; they would only be part of a wider scheme. They would not naturally be selected from London, because they were needlessly high. Therefore it certainly seemed to him to be a most dangerous and unjust request that, if there did exist this immediate demand for a supply in Birmingham, it should be postponed for the reason that some possibility might arise of some other community—not necessarily, but exercising a choice—might come in with a preference for this particular district, although it would not be sufficient for the purpose. The learned Counsel went on to say that the estimated cost of the scheme was £5,851,000; and the capital asked for to cover contingencies was £6,600,000. It was a large scheme; but the Water Committee, of course, designed that it should be economically administered, and that it should not be developed at one stroke, but gradually. They proposed to acquire the land itself. Their object was not to extinguish any rights vesting in anybody, so far as these could be exercised with due regard to the protection of the soil from pollution. The Corporation of Birmingham did not desire to become land-jobbers; they merely hoped to secure efficient control.

The CHAIRMAN: Is it a usual or an unusual thing for a Corporation to acquire the actual soil?

Mr. POPE said that, in the case of large communities, it had of late years become frequent, though he would not say common. Manchester acquired it in taking Thirlmere; and Liverpool very largely in taking the Vyrnwy. He had received two reports with reference to the Bill—one from the Board of Trade, and the other from the Home Office. The former had reference to compensation water, and bore also upon the question of fisheries. It suggested that, in view of the difficulty of constructing such fish-ladders as would not at all interfere with the spawning, it would be best that the compensation on this head should take the form of money. As to the compensation water, it was based on similar calculations to those which Parliament sanctioned in connection with the Liverpool and Manchester schemes. The Home Office report he would deal with later, as it had not been printed. Passing on to the petitions, he said he should ask the Committee to set that of the Hereford Corporation aside, as having been drafted in needless alarm for the River Wye. Of the petition against the Bill presented by certain Birmingham property-owners, he said he had supposed that the suggestion it contained of a dual system of supply had been long ago exploded in the mind of everybody of common sense. To him, familiar as he was with most of the discussions which had taken place of late years, its appearance was like a revival from the Middle Ages; and he would wait with some curiosity to hear what fossil owner of property in Birmingham would venture to come forward and say he still entertained the opinion that this dual supply was a practicable idea.

At the conclusion of the learned Counsel's address, evidence in proof of the preamble of the Bill was then given.

Sir *T. Martineau*, examined by Mr. BALFOUR BROWNE, said he was Chairman of the Water Committee of the Birmingham Corporation during the mayoralty of Mr. Alderman Avery; and at the end of his own term of office as Mayor in 1887, he was again appointed Chairman, and had been so ever since. The water-works had been the property of the Corporation since the end of 1875; and the Water Department was regulated by the Consolidation Act and the general statutes incorporated with the Local Act. Under the latter Act, no water-rate was levied on ratepayers in the city. Witness described the water area comprised within the present limits of supply; the total extent of the district being 83,221 acres. He put in the details referred to by Mr. Pope, in his opening address, as showing the increase of inhabited houses and population in the area of distribution during the three decades ended 1871, 1881, and 1891. Proceeding, he said the increase in population was not, on the whole, so large between the years 1881 and 1891 as between 1871 and 1881; and it was very unevenly distributed. In the districts which were within the city, as well as in several of the large suburbs, enormous increases had taken place. There was no suburb of Birmingham which was not within the water limits. When all the land in the city and suburbs became occupied, there would remain inside those limits a belt of pure country which might gradually assume a more or less suburban character. Therefore, speaking generally, every house that was built, whether in the city, in its present suburbs, or in the suburbs of the future, would require a supply from the Water Department. The growth of Birmingham during the century had been enormous; and he saw no reason why it should stop. He believed, notwithstanding fluctuations in trade, it was, altogether, a thoroughly thriving and prosperous place, and likely to continue so. Birmingham had, in an especial degree, this element of steadiness about it—that its prosperity did not depend upon any one trade or branch of trades. Witness proceeded to show how, mainly in consequence of the increase of population, the quantity of water supplied had augmented. He also repeated the account given by Mr. Pope of the present supply. He added, on this point, that, in view of long-continued drought, the Water Committee were hardly able even now to meet thed emand. As to future requirements, the estimate of the Water Engineer (Mr. Gray) showed the following figures:—

	Total.	Average per Day.	Maximum per Day.
1893 ..	6,387,000,000 ..	17,500,000 ..	22,000,000
1900 ..	7,665,000,000 ..	21,000,000 ..	26,000,000
1915 ..	10,950,000,000 ..	30,000,000 ..	36,000,000
1941 ..	16,425,000,000 ..	45,000,000 ..	60,000,000

Continuing, witness said he believed Mr. Mansergh placed the average in 1941 at a much higher figure. According to this calculation, the present means of supply would be insufficient to meet the consumption of 1900. If there should be a serious drought, even several years earlier than that, the Water Committee would be quite unable, with the present means, to meet the demands on their resources, and would be obliged to curtail the daily supply to the inhabitants. Liverpool obtained its Act for the Vyrnwy scheme in 1880; and Manchester, for the Thirlmere scheme, in 1879. In neither case were the works yet quite complete. If, therefore, Birmingham was to deal with this matter by a comprehensive scheme, it had not a day to lose. Proceeding, witness traced the various steps taken by the Water Committee in view of the approaching need for more water. The suggestion of the Rivers Elan and Claerwen as sources of supply for Birmingham was not new. In the year 1871, while the water undertaking was in the hands of the original Company, Mr. (now Sir Robert) Rawlinson was consulted by the Public Works Committee of the Corporation on the whole subject. He prepared an elaborate report, in which, discussing the possible local sources, which he condemned as either unsatisfactory or insufficient, he dealt with those at a distance, and concluded with a strong recommendation that a supply be obtained from the rivers named. The report was before the Water Committee during their investigation a year ago. The reasons that guided them to their conclusion were these: (1) There were no local rivers, beyond those now used, which were available. (2) The development of the Bourne supply was unsatisfactory, as it would not suffice for more than 20 years, and would probably cost a sum approaching £1,000,000, which would be wasted if (as seemed inevitable) a supply from distant sources would sooner or later be necessary. (3) If the fouling of streams now utilized should require the abandonment of some of them (as had already been done in the case of the Tame), the new works might prove insufficient long before the expiration of the 20 years. (4) As to deep wells, while good water had been derived from them, experience had taught that this source of supply was most uncertain; and it was impossible to calculate what quantity of water could be expected from any new well. In the time of the Company, there was a great failure at the King's Vale well, which was expected to yield 6,000,000 gallons a day, and produced—and still continued to do so—only 300,000 gallons. It was this failure which led Mr. Gray to advise the Company to go to the Bourne and Blythe. The Selly Oak well was expected to produce 2,000,000 gallons a day; and the engines were constructed to pump this quantity. The result at first was only 800,000 gallons. This, by driving headings, was afterwards increased to 1,200,000, at which it now stood. In 1888-9, the Committee tried borings in a site which, from its geological position, appeared most eligible, on the confines of Edgbaston and Harborne; but, after losing a good deal of time and some money, they had to abandon it altogether, as no supply could be obtained to make it worth while to go on. The Longbridge well, though not fully tried, did not promise to yield so much as had been expected. (5) The new scheme seemed to meet the peculiar physical difficulties of their situation, arising from the elevation of the city above the level of the sea. (6) The water from the proposed sources promised to be all that could be desired as to quantity, quality, and freedom from the chance of pollution. (7) The financial part of the scheme seemed well within the resources of the Water Department.

On the following day, Sir T. Martineau was further examined by Mr. Balfour Browne, and cross-examined by Mr. Pember and other Counsel for the opponents. The Mayor of Birmingham (Mr. Lawley Parker) then gave evidence in corroboration of that of Sir T. Martineau; and the Committee adjourned. On Monday, the 4th inst., the engineering part of the scheme was opened—Mr. James Mansergh, M.Inst.C.E., being the first witness. He was under examination and cross examination all day. On the following day his cross-examination was concluded; and witnesses were called to give geological and chemical evidence in support of the Bill. Mr. Gray, the Water Engineer of the Corporation, followed; and subsequently Mr. Thos. Hawksley and Mr. G. H. Hill. The promoters' case was then brought to a close; the opposition of the Wye Fishery Board and the Commons Preservation Society having in the meantime been withdrawn as the result of an arrangement. These matters engaged the Committee's attention till the time for rising on Thursday, the 7th inst. The next day—the seventh of the inquiry—Mr. Pember and Mr. Lawrence opened the caess of the London County Council and the Hereford Corporation; and at the conclusion of their addresses, the Committee adjourned until the 2nd of May. The proceedings here briefly summarized will be reported in subsequent issues of the JOURNAL.

Bombay Gas Company, Limited.—In the report to be presented to the shareholders of this Company at their meeting on the 5th prox., the Directors state that the gas and meter rental for the twelve months ending Dec. 31 last shows an advance on the previous year of £2354. The returns for residual products and the profits on the sale of fittings have been less favourable. The loss on exchange amounted to £18,812, which has been charged to profit and loss. The profit was £17,925; and including the balance brought forward, £18,394. After deducting the interim dividend at the rate of 3½ per cent., the balance available is £9994, from which the Directors recommend a dividend of 4 per cent., tax free, making 7½ per cent. for the year, and leaving £394 to be carried forward. The Directors announce with regret the retirement of Mr. W. B. M. Lysley as a Director. They have appointed Mr. H. E. Jones, M.Inst.C.E., one of the Auditors of the Company, to fill the vacancy; and Mr. Jones is succeeded by Mr. Magnus Ohren, Assoc.M.Inst.C.E. Both of these gentlemen will retire at the meeting, and offer themselves for re-election.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Tuesday, April 5.

(*Before the* MASTER OF THE ROLLS *and Lords Justices* FRY *and* LOPES.)

The Attorney-General (on the Relation of the Local Boards of Chadderton, Royton, Crompton, and Failsworth) v. Mayor, &c., of Oldham.

The Gratuitous Supply of Gas for Public Lighting.

This was an appeal from a decision of Mr. Justice Collins on Oct. 29 last year, in an action brought by the above-named Local Boards to compel the Corporation of Oldham to bring into their accounts, as part of the finances of the gas undertaking, the cost of lighting the public lamps in the borough, which are supplied gratuitously. The proceedings in the Lower Court were reported in the JOURNAL for Nov. 3, 1891 (p. 804); and they resulted in a judgment for the defendants. The plaintiffs appealed; but, as already stated, they failed to sustain their contentions. The following short report of the arguments and judgment is now given to complete our record of this important case.

The ATTORNEY-GENERAL (Sir R. E. Webster, Q.C., M.P.) and Mr. DANCKWERTS appeared for the appellants. Sir H. James, Q.C., M.P., was in attendance as representing the respondents; but he was not called upon, except occasionally, to indicate their case. They admitted that they had not since 1887 included the cost of supplying their streets and public buildings with gas; but they denied that this was in contravention of the Act.

The ATTORNEY-GENERAL said he appeared for the Local Boards acting as the Sanitary Authorities for the four outlying districts to Oldham of Chadderton, Royton, Crompton, and Failsworth, which receive their gas from the works of the Oldham Corporation. They were seeking, in substance, to restrain the Corporation from supplying the public lamps there without bringing into their accounts the value of the gas so consumed, and so giving the outlying districts the benefit of these receipts. The gas was originally supplied by the Oldham Gas and Water Company, whose undertaking had passed into the hands of the Corporation, which during the last four or five years had omitted to carry the cost of lighting their lamps—amounting to something like £6000 a year—into their accounts. They thus prevented the reduction in the price of gas, to which the relators contended they were entitled, under an Act of 1886, on the charge made to the outlying districts of £2 per lamp per annum; the Corporation not having the power to make a profit out of those districts, which were once charged 2d. per 1000 cubic feet more than the price paid in the borough—a provision which was repealed by a later Act, under which the Corporation were only entitled to accumulate a reserve fund of some £50,000 to pay off certain annuities created on the acquisition of the works; with a sum equal to 6 per cent. upon their outlay, following which the outlying districts would be entitled to a *pro ratâ* reduction in the charge to them for their gas supply. The present position was brought about in the following way: A Gas and Water Company for Oldham was incorporated in 1826 as a joint-stock undertaking; there being no limit to the price that could be charged for gas, and the principle of the sliding scale had never been enforced in the town. The undertaking was transferred to the Corporation of Oldham in 1853, the shareholders receiving £10,000 a year perpetual annuities, payable by the Corporation and chargeable on the borough funds, through a sinking fund, by an Act granted to the Corporation in that year. In 1855 the Corporation obtained a second Act; and by it the price of gas was, for the first time, limited to 5s. 6d. per 1000 cubic feet. In 1865 the Oldham Borough Improvement Act was passed. It repealed the Act of 1826, and the later Act of 1853, except in regard to the obligation relating to the annuities; and it reduced the price of gas to 4s. 6d. per 1000 cubic feet. The learned Counsel proceeded to critically and exhaustively pass in review the provisions of this measure, with the object of showing that the Corporation were empowered to light the streets and public buildings of the borough, to contract with outlying authorities for similar purposes, and also to supply gratuitously third persons who would otherwise have to pay for gas both within and beyond the borough, subject to certain restrictions as to the class of institution (hospitals and the like) to whom this should apply. But, he said, they were to keep accounts; and, as a matter of fact, they so kept them until 1887. In that year they reported that, prior to their further Act of 1886, their gas profits, ranging over a period of 20 years, averaged about £11,000 per annum; but since then the street lamps and municipal buildings had been supplied with gas free. He submitted that the Corporation could not, under their statutory powers, practically make the outlying districts contribute to this supply to the streets and public buildings of Oldham, which was what the relators complained of—the Corporation not having, since the first half of 1887, brought into account a single penny for the gas so consumed; the effect being to call upon the outlying districts to contribute to this cost. He submitted that, on the face of the Acts (from which he gave copious quotations and comments), it was intended that the gas undertaking of the Corporation should be conducted in identically the same way as a company would conduct it; otherwise the outlying districts would not get the protection to which they were entitled. The Corporation admitted in the Court below that if they burnt coke in the fire-places of the offices belonging to the Corporation they must bring it into account; and why should they not also include the value of the gas consumed for the public lighting? Under the existing system, the outlying districts were charged with £6000 a year for public lighting, as distinguished from private gas supplies; and the borough paid nothing. The learned Counsel continued his arguments at great length.

Mr. DANCKWERTS followed; and read the judgment of Mr. Justice Collins in the Lower Court, to the effect that the case turned upon the construction of the different Acts of Parliament under which the operations of the Corporation were conducted. The section most discussed was the 96th of th Act of 1865, which rovided that the Corporation might supply gas or water gratuitously for any purposes of public advantage within the limits of the Act, and might supply gas gratuitously for lighting, and water for domestic and sanitary purposes to any hospitals and infirmaries, public baths, and washhouses, maintained at the expense of the Corporation, or out of the rates for the relief of the poor. His Lordship came to the conclusion that, as long as the outside districts were charged no more than the statutory price for gas, they had no *locus standi* to inquire whether the Corporation gave away their gas or charged other people more or less than they charged them. He consequently gave judgment in favour of the Corporation.

At the conclusion of the arguments,

The MASTER of the ROLLS said he was of opinion that the appeal should be dismissed. It must be clear to everybody that down to 1886 the outlying districts had no right to look into the Corporation accounts. All they had to do was to pay what they had contracted for within certain defined limits. But in 1886 they obtained a right to see what were the "profits" made by the Corporation on their gas undertaking; the charge to them for gas being reducible *pro ratâ* on the following provision in the Act: "The Corporation shall not, after the year 1887, make out of their gas undertaking a greater profit than the annual amount for the time being payable"—first, by way of annuities created for the purchase of the undertaking, next for something else, together with a sum of 6 per cent. per annum upon yet another thing; it being added that the expression "profit" was to mean the profit made by the Corporation out of their gas undertaking after paying all the expenses of the manufacture and distribution of gas and all rents. Proceeding to review sections 96 and 97, which had been frequently quoted in the arguments, his Lordship said it was obvious that in neither case did the Corporation make a "profit;" for lighting the streets or supplying public buildings might be a benefit, as had been told them often enough, but it could not be called a profit which could be carried into an account. This appeared to be the principle on which Mr. Justice Collins had based his judgment, which he thought should be upheld, and the appeal dismissed.

Lords Justices FRY and LOPES concurred.

The appeal was therefore dismissed, with costs.

STAFFORDSHIRE QUARTER SESSIONS.—Wednesday, April 20.

(*Before Mr.* T. F. TWEMLOW, *Chairman, and a Bench of Magistrates.*)

The Assessment of the Birmingham Corporation Gas-Mains.

A special adjourned sitting of the Court was held to-day to hear an appeal brought by the Gas Committee of the Birmingham Corporation against the assessment by the Assessment Committee of the King's Norton Union of gas-mains in the parish of Harborne.

Mr. DANCKWERTS and Mr. KETTLE appeared for the appellants; Mr. YOUNG, Mr. PRITCHETT, and Mr. SHAKESPEARE for the respondents.

Mr. DANCKWERTS, in opening the case, said the assessment appealed against was £480 gross and £400 net; and the Corporation held that the proper assessment was about £200. The appeal involved the rateability of the Corporation in respect of such part of their gas-mains as were in the parish of Harborne, in the union of King's Norton; but although only one parish was involved in the present case, in substance it had an indirect bearing on the rateability of the Corporation in other parishes and in other counties. Hence the importance of the appeal. If it were merely a question of Harborne, it would perhaps not be worth fighting. But it involved ulterior matters; and the Corporation were compelled to come before the Court and seriously contend as to what was their real rateability. There were no works in the parish, nor any indirectly productive mains; they were solely non-productive mains as to which the appeal was taken. The rateable value of the indirectly productive works was £39,644; and this, at a rate thereon of 6s. in the pound, realized £11,927. This would give them a total value of the works and dead mains of the Corporation, *plus* rates, of £51,571. The former rating of the Corporation in the parish of Harborne was £272 net; and that was fixed in 1885 between the Secretary of the Gas Committee and Mr. Matthews, who then acted for the parish, there being an agreement that the figures should continue for five years. The above amount was arrived at upon the average of the rates, calculated on the actual working of the concern in the years 1883 and 1884. On Feb. 25, 1891, the Corporation received notice under the Union Assessment Committee Amendment Act of 1864 that a supplementary valuation list had been deposited; and in this the Corporation were rated in the parish of Harborne at £400 net and £480 gross. They immediately made inquiries, and found that the Assessment Committee sat on June 17 to hear appeals; and the Corporation appeal was heard, but all relief was refused. The rate against which they were appealing was made on April 10, 1891; and this was an important date to be borne in mind. Owing to the passing of the Local Government Act and the arrangements in connection therewith, the Corporation changed their financial year from the calendar year to March 31. This took place in 1891. They proposed to work out their assessment upon the accounts for the calendar year 1890; and they also intended to ask the Bench to look at the accounts as worked out for the year ended March 31, 1891, which was the complete year immediately before the rating. They asked the Bench to fix something between the two as being fair. The greater part of the profit for 1890 was made in the first quarter of that year; and in the remaining three quarters of the year, the profits fell very much, and continued to fall for the first quarter of 1891. The fall was still going on; the reason being connected with the price of labour, coal, and residuals. The gross profits on 1890 were very much larger—some thousands—than the profits in the year ended March 31, 1891; and if the latter year were taken for the assessment, it made a considerable difference in the amount they would have to pay for Harborne.

Mr. YOUNG remarked that he thought the proper year to be taken was 1890—from Jan. 1 to Dec. 31.

Mr. DANCKWERTS said he did not know whether it made any difference; but he believed the accounts for the year ended March 31, 1891, were not published by the Corporation until May, or a month or

so after the rate was made. In 1875 the works belonged to two Gas Companies; but they were acquired by the Corporation. The price of gas then was very much more than now. There had been four reductions since the acquisition, and one increase in 1887—the rate being the same now as in 1887. The Corporation supplied gas not only to the city, but to various outlying districts; one of these being Harborne. In the Act of Parliament, they were expressly prevented from charging consumers outside the city more than consumers inside. There was also power given to the outlying districts, for the first time taken into the area of supply, to cut themselves off on certain terms. One very practical question in connection with the outlying districts was that one-fourth of the whole supply was taken by districts outside the city; and the Corporation had, with a view to future contingencies, been obliged to invest capital in extending their works beyond the city to a very great extent. It was of the utmost importance that the price of gas should not be driven up with a view to benefiting the Corporation fund; and thereby inducing the outlying districts to themselves take steps to have their own supply, and so diminish the value of the Corporation works. There were several competing factors to be taken into consideration, such as electricity and oil; and the latter was a most powerful competitor. Consequently, the Corporation dared not raise their prices unduly. Again, they had to stimulate consumption by opening up a future for gas in the way of heating and cooking, and for manufacturing purposes; and this could only be done as long as the price was low. Directly the charge went up above a certain ratio, the manufacturer could not use it; so that, by increasing the rates, they would be "cutting off their nose to spite their face." The artizan classes, too, could only get the gas if it were cheap. If it were not, they would burn oil; and this had to be taken into account in fixing the price. The learned Counsel pointed out that there was a differential charge according to the amount consumed, and went on to say that they had taken the total receipts for gas, residuals, &c., and had deducted from this the total expenditure, with the exception of rates, and they then arrived at what might be called the net receipts, which for the calendar year 1890 were £134,364. For the year ended March 31, 1891, the same figures were £130,164, or a reduction of £4200. He proceeded to deal with the deductions, and said that, in calculating what should be the tenant's capital, they had taken the usual universal 17½ per cent., which would amount to something more than £60,000. Then they took the landlord's share; and they worked it out that that, including sinking fund and repairs, &c. (which had to be borne by the landlord), amounted to £117,000. This would be the gross rateable value of the whole, *plus* rates. The net rateable value, *plus* rates, was £79,330. Deducting from this the £51,571—the amount of the indirectly dead mains—it made the rateable value of the directly-productive *plus* rates £27,775. The total receipts from gas were £435,149 for 1890; and the same figure for Harborne alone was £4385. The rates of Harborne were 5s. 3d. in the pound; and the net rateable value of the mains there in the calendar year of 1890 was £221. The same figure upon the accounts for the year ended March 31, 1891, worked out at £178. He asked the Bench to fix something between £221 and £178; and the Corporation would be satisfied. In strictness, he thought he should be entitled to say they should take the accounts for the year ended April 10, 1891; and that would bring them to £178. But they were willing, in order to secure a fair assessment, to take a figure between the two. They could not advance the price of gas, unless they could justify it by the increased price of material and labour. If the gas charges were unduly put up, the burden fell on the consumers; and the part of Harborne which consumed gas was represented by him in fighting that appeal.

Mr. *H. E. Jones*, Engineer of the Commercial Gas Company, said the accounts of the Birmingham Gas Committee had been put before him; and he had carefully inspected the works, tools, &c. The gross profit was 5¾ per cent. on the year they had taken into account. Witness was examined at length as to the rating of the works, and the various deductions that should be allowed. He said the assessable receipts of the undertaking for the year ended Dec. 31, 1890, amounted to £567,000. The ordinary expenditure was £323,000; leaving £244,000. Repairs, insurance, and sinking fund amounted to £100,000. Therefore the gross value of the undertaking was £143,000, of which £64,000 would be appropriated to tenants' income, and £79,000 would be the rateable value of the concern. After deducting the rateable value of the works and the rates thereon, amounting to £51,000, they had £30,000, as the rateable value of the mains in all the unions. This latter sum had to be divided among the different parishes according to the rates in each parish, as compared with the receipts in that area for the whole undertaking. The figures for the year ended March 31 were: Assessable receipts, £578,000; ordinary expenditure, £341,000—leaving a balance of £237,000; gross value, £174,000. Repairs, renewals, sinking fund, &c., £100,000, of which interest and tenant's capital would amount to £64,000, leaving the whole rateable value at £73,000. The same amount, as in the year before, would be appropriated to the works, leaving £22,000 as the rateable value of the mains, to be apportioned as before. He had sought throughout not to bring out the lowest possible figures, but to arrive at fairness. Supposing he had a tenant willing to take the works at a fair rent, he should fix the figures as he had done. They could not get tenants for such large undertakings; no one short of a Rothschild could work them. He had not put a penny into the tenant's capital beyond what the Corporation had to employ being their own tenant.

The CHAIRMAN said his own impression was that the assessment must be founded on the year ended December, 1890.

In cross-examination by Mr. YOUNG, witness said he had been personally engaged for four or five months in preparing the mass of figures he had produced. He assisted his father against the Corporation when the gas-works were acquired. He was engaged on behalf of West Bromwich in the arbitration. The rateable value of the dead mains of the whole concern was £22,981; and, adding the rateable value of the live mains (£39,644), they had a total rateable value of £62,625 for the year 1890. The Corporation paid in annuities in 1890 £34,306; the interest of Birmingham Corporation stock amounted to £19,699; and the interest on mortgages and bonds, &c., £6417—making a total of £80,423.

Mr. YOUNG: Deducting the net rateable value, £62,625, it appears that the Corporation were short of £17,798 between their net annual value and the three items which they have to pay?

Witness: No, I do not see the connection. Witness further said the gross profit of 5¾ per cent. was on the £2,326,261, the total expenditure; and it included the goodwill paid for the concern.

Thursday, April 21.

On the resumption of the proceedings this morning,

Mr. *Jones* was further cross-examined. He said he was not aware that the average annual gross profits of the gas undertaking from 1876 to March, 1891, had been £140,068. A sum of £95,610 per annum had been allotted for the discharge of annuities and so on. The average annual balance of profit carried to the improvement rate and the borough fund was £45,458.

Mr. YOUNG: This is a concern, as far as I understand the contention, that is not to make any profit?

Mr. DANCKWERTS: You must not take the last figure; it is not correct. I did not say we were not to make any profit. I said we were not to deal with the undertaking as a commercial concern, which was making as big a profit as possible.

Mr. YOUNG (to witness): Do you know the Corporation have built an Art Gallery out of the profits.

Witness: I dare say.

And paid £25,000 to the improvement scheme?—I do not know.

Has £21,679 per annum been written off capital?—I do not know.

You have had a good many months' experience in making up these accounts; do you know the Corporation have, out of revenue, been extending their works and erecting new plant and gasholders and tanks?—I am not aware that they have done so.

You have got no shrewd suspicion of it?—No; I know they have expended £90,000 a year in renewals and repairs. I know nothing about the undertaking prior to three years ago.

The CHAIRMAN: Perhaps he does not choose to know.

Mr. YOUNG: In 1881, the amount charged to revenue under the head of new buildings, gasholders, &c., partly in substitution for old ones, was £22,691.

Mr. DANCKWERTS: What have we to do with 1881?

Mr. YOUNG: We have to find out the true state of the concern in 1890 for making the basis for the rate.

Witness: I am a Justice of the Peace, and am aware of the importance of what I say. I am a professional man of some standing; and I have sworn to suppress nothing, and to confine myself to the truth. I would rather be relieved of this case, if anyone thinks otherwise.

Mr. DANCKWERTS: I am sure the Chairman did not mean what he seemed to say.

The CHAIRMAN: Oh; we have said nothing.

Cross-examination continued: The net rateable value of the mains was £22,981. In 1890, the receipts for gas in Harborne were £4385; and in 1889, £4035.

Mr. YOUNG: If there has been anything like a progressive increase in Harborne, the receipts from gas from 1885 to 1890 would increase; and that would strike you as a *prima facie* reason why the assessment of years ago was too little now?

Witness: Not unless the undertaking was working at that time at more profit.

Prima facie it would strike anybody that the rateable value in 1890 under these circumstances must be greater than in 1885?—No. In 1890 we have got into a fresh period. We have now labour and coal questions, which we had not to contend with before.

But you have raised the price of gas?—I suppose they have.

Witness further stated that he had not included £2105 for fittings under the head of receipts.

Mr. YOUNG said he contended that this ought to be included.

By a MAGISTRATE: Any tradesman could do the fitting work besides the Corporation. He took the £2105 for fittings to be profit on trade which the Corporation carried on; but consumers were not obliged to employ the Corporation to do the work. The £2105 was a trade profit, which they must not assess.

Mr. YOUNG: What about the meters?

Witness: They are different; they are essential to the supply of gas.

Mr. YOUNG: Your receipts amount to £565,843, less bad debts; and our receipts amount to £567,948—the difference between the two being the one figure for fittings.

Witness was taken at length through his valuation of the stoves, &c., at the various works, which he said did not vary appreciably from year to year. He was not aware that the Town Clerk had been asked for particulars of book debts, and had refused to give them. The sale of gas for the year ended Dec. 31, 1890, was 3,751,000,000 cubic feet; and for the year ended March 31, 1891, 3,810,418,000 feet—an increase of 59,000,000 feet.

Friday, April 22.

Mr. *Jones* was this morning re-examined by Mr. DANCKWERTS, upon the figures which had been put in in support of the appellants' case. He said that lowering the price of gas would be likely to increase the consumption, especially now when gas was being so much used for fuel, and to increase the price would check the demand.

Mr. *G. S. Mathews* said he had had considerable experience as a valuer. In 1885 he agreed on the value of the plant of the appellants at Harborne at £272 on behalf of the present respondents. He had prepared an assessment of the mains at Harborne for the year ended Dec. 31, 1890; and it worked out at £239 net rateable value. The valuation for the year ended March 31, 1891, came out at £170. He took the entire receipts for gas, less discounts, &c., at £566,725. In the expenditure, he had omitted those items which did not concern the manufacture—such as the cost of maintaining the recreation ground, and expenses on loans and annuities. He had also omitted the rates, which had to be ultimately deducted, and the repairs, which he dealt with separately; and he found the total expenses came to £323,293. He had deducted from the expenses balance of discounts on purchases, part of which was for fittings; bringing the net sum down to £244,101. From the net receipts, he deducted the tenants'

interest, 17¼ per cent. on a capital of £344,786, which was £60,337; and deducting this latter item from the £244,101, he had left £183,764. With regard to repairs, he had taken what he estimated to be the average annual repairs and depreciation which had appeared in the balance-sheet for the last ten years. He found that from 1880 the average amount for repairs, renewals, and depreciation was 6·36d. per 1000 cubic feet of gas sold; and this amounted to £99,422. Previously he had always allowed 7d. per 1000 cubic feet sold; and he did this because it was a fact that in 1880 the sum spent on repairs and renewals by all the London Gas Companies amounted to about 7¼d.—7d. had been the recognized figure for surveyors to take. Then he had deducted the insurance, which amounted to £3000; but he found that £94 had been paid by the Corporation for insurance of some small part of the undertaking, and deducting this he arrived at £2906. Roundly, the rateable value of the whole undertaking was £81,436. In addition, the value of the unproductive works had been agreed at as £39,644. The rates were £11,927; making the unproductive works £51,571. He deducted that from the rateable value of the whole undertaking; and this left the rateable value of the mains at £29,865. The corresponding figure for the year ended March 31, 1891, was £20,996. He then had to find the rateable value of Harborne. The gross receipts for the whole undertaking were £435,149; and the gross receipts in Harborne £4385, which gave him a proportionate rateable value of mains for Harborne of £301. Deducting rates at 5s. 3d., brought the rateable value down to £239. For the year ended March 31, 1891, the rateable value was only £170.

Cross-examined by Mr. PRITCHETT, witness said the fair valuation arrived at in 1885 was not based on any one year. The receipts for Harborne in 1884—the account year on which he based his decision—were £3438; and they had since increased to £4300. His valuation on the 1884 accounts was £220.

Mr. PRITCHETT: How did you get up to £239?

Witness: I decline to be bound by the figures that were put before me, because I saw that the general accounts in the previous year showed a very much higher profit; and I would not accept that. I was making an arrangement that was to last for five years; and I fixed £239. The gross profit on the undertaking in 1884 was exceptionally low, and only amounted to £125,000. In 1890 the gross profit was £136,000; and in 1883, £152,000. I cannot say whether a hypothetical tenant working the concern would be likely to make a larger profit than the Birmingham Corporation.

What would be a fair percentage in the way of rent from a tenant who does his own repairs?—I think the landlord ought to get (say) 4 per cent.

Do you agree that the value of the landlord's part of the undertaking has not depreciated since it was taken over by the Corporation. Supposing the Corporation sold again, would they get a less amount than they gave?—I cannot say that. The value of the works is about a million and a half; and the proper interest for the value of the works is about 5 per cent.

My calculation is that your valuation carried out on a capital of £1,800,000, works out at 3·44 per cent. Is that sufficient for the landlord's capital invested in the concern?—I should think it was scarcely enough.

I am trying to show the *primâ facie* unreasonableness of your valuation, which only gives the landlord 3·44 per cent. on his outlay?—I should think he ought to get a little more than that.

The CHAIRMAN said that whether right or wrong, the accounts presented by Mr. Mathews were understandable; and he thought they might close the case for the Corporation that day, and when they met again they could go on with the respondents' case.

Mr. DANCKWERTS: After what has fallen from the Bench, I do not think I will call another witness.

The CHAIRMAN: I understand Mr. Mathews's figures, whether correct or not; and we can digest them at leisure.

Witness was then re-examined by Mr. DANCKWERTS, and said that gas affairs had not improved since 1885. The profits had fallen, notwithstanding a very largely-increased make and sale of gas, due to the fall in the price of residuals, and an increased price of coal and labour. He did not think the Corporation did badly when they obtained 3·44 per cent. as rent on outlay and capital.

Mr. YOUNG then addressed the Court for the respondents; saying that he agreed with Lord Esher that these rating cases were made to puzzle mankind. If Lord Esher had been here when they commenced the case, and had had handed to him the valuation with the various schedules of Mr. Jones, he could hardly venture to predict what additional observations of force he might have made with respect to rating cases. In 1885, Mr. Mathews, acting on behalf of the rating authority, and Mr. Edwin Smith, the Secretary of the Corporation Gas Committee, put their heads together for the purpose of arriving at the rateable value of that part of the undertaking situated at Harborne at a figure to inure for five years. The assessment was fixed at £272, and at that time the receipts were only £3438; whereas in 1889 they were £4035, and they had further increased to £4385 in 1890. There ought, therefore, to be an increase in the rateable value of the Committee's undertaking in Harborne. The profits of the whole concern in 1890 were £136,000, or £900 more than in 1885. There was no doubt that in 1890 the price of coal went up very much; but if coal had remained at its normal price, the £136,000 profit would have been much larger than it was. He was aware it was said that labour and material had risen in value. But the price of coal was inordinately high throughout 1890; and this would account, to a great extent, for no higher profit being made. Bearing this in mind, it was a remarkable thing to find that the receipts had gone up by more than £900, between 1885 and 1890. The rateable value, according to Mr. Jones, on the 1890 accounts, was only £221; so that, instead of the rateable value progressing hand-in-hand with the increase in the receipts from the parish, the appellants made it out that, although they had gone up, they yet resulted in a diminution of the rateable value. He did not think any possible dealing with the accounts could ever establish the proposition that the rateable value ought to be less at the present time than in 1885.

The Court adjourned before the completion of Mr. Young's address, and will not meet again until May 17.

MISCELLANEOUS NEWS.

GAS SUPPLY IN THE COLONIES.

In the JOURNAL for the 29th ult. (p. 588), we gave some particulars as to the working of certain Colonial gas undertakings, extracted from reports and balance-sheets which had lately come to hand. We have since received a report of the annual general meeting of the Christchurch (N.Z.) Gas Company, on which occasion the Directors stated that the business of the Company continued fairly satisfactory. The balance-sheet showed the revenue for the past year to have been £29,918, as against £27,916 in the preceding twelve months. The balance to the credit of the profit and loss account, with the amount brought forward, stood at £10,852. Last July an interim dividend of 5 per cent. was declared, which absorbed £5000; and the Directors recommended the payment of a further dividend of 5 per cent.—making 10 per cent. for the year, and leaving £852 to be carried forward. The Company have 61 miles of mains; and the number of public lamps is 561. As to the quality of the gas supplied, the average was 18 candles. During the year additional coal storeage accommodation was provided, which now enables the Company to keep a stock of raw material sufficient for several months' use. The retort-house has been extended; and the number of retorts is being increased for future requirements. The Company have a show-room for gas appliances; and they have found it to be a very successful means of bringing before the public the advantages of gas for culinary, heating, and industrial purposes. The Chairman of the Company (Mr. E. G. Wright), in the course of his remarks when moving the adoption of the report, stated that the business of the Company had increased to the extent of about 7 per cent. as compared with the year 1890. This being the case, the amount to the credit of the profit and loss account might not be so great as some had anticipated; but there were two or three causes which had militated against a larger profit being earned. In the first place, there was a considerable accumulation of inferior coal, the outcome of the strike in 1890, when, as the Grey Valley Company's mine was closed, coal had to be obtained wherever possible. In the next place, there had been an exceptionally heavy expenditure in repairing the plant, all of which the Directors had very properly decided to charge to current account. The third item was an increase in the wages paid to the stokers, the outcome of the eight-hour system adopted in 1890. Notwithstanding these sources of expenditure, the prospects of the Company were very satisfactory. The report was adopted, and the dividend recommended declared. A vote of thanks was accorded to the Secretary (Mr. C. W. Bishop), the Manager (Mr. D. B. Mackenzie), and their various assistants; and a similar compliment to the Chairman and Directors brought the proceedings to a close.

The other Colonial Gas Company whose progress calls for brief notice is the Latrobe, of which Mr. T. S. Cleminshaw, C.E., is the Consulting Engineer, and Mr. H. S. Wark the Manager. This is a small concern; the receipts for gas amounting last year to only £1043, and the total income to £1286. After paying expenses, there was left a sum of £434 to go to the profit and loss account; making, with the balance of £256 standing over, a total of £690. But as dividend and interest to the amount of £425 had been paid during the year, there was a balance of £265 only to be dealt with at its close. Out of this the Directors recommended the payment of a dividend for the second half of the year at the rate of 7 per cent. per annum; amounting with the tax to £191, and leaving £74 in hand. The quantity of coal carbonized in the twelve months was only 179 tons; the production of gas being 1,593,000 cubic feet, or 8900 cubic feet per ton. The Company have reduced the net price of gas to 13s. 4d. per 1000 cubic feet, as from Jan. 1 last.

BOSTON (U.S.A.) GAS SUPPLY.

An Official Inquiry into the Boston Gas Company's Affairs.

In the JOURNAL for the 8th ult. (p. 448), we gave, on the authority of a local correspondent, some "Facts about the Boston Gas Companies." We learn, from communications since received, that an inquiry has lately been going on by the Board of Gas and Electric Light Commissioners into the affairs of the Boston Gas Company. They were set in motion by an order from the Massachusetts State Legislature, dated the 26th of February last, to report, within 30 days, on the following points: "(1) Whether or not the Boston Gas Company has within the past six months made any advances in its charges for gas. (2) At what price the Boston Gas Company can manufacture gas delivered in its holders and at the meters of its consumers and pay dividends of 8 per cent. on its capital stock, and provide for all needed renewals and extensions of its plant. (3) To what extent the Boston Gas Company is hiring the use of pipes from another corporation at an excessive rental, and to what extent the Company is paying another corporation $1 per 1000 cubic feet for gas, which it could manufacture for a less sum per 1000 feet. (4) As to whether the Bay State Gas Company diverts the surplus earnings of the Boston Gas Company into the treasury of a foreign corporation known as the Bay State Gas Company of Delaware." These matters were duly investigated by the Commissioners, who were empowered to order the production of books and papers, and to compel the attendance of witnesses; and, on the 25th ult., they presented a report, of which the following are the principal portions.

The Commissioners found that on Nov. 11, 1887, the Directors of the Boston Gaslight Company authorized three-year contracts at $1 per 1000 cubic feet with all consumers whose bills had theretofore exceeded $2000 per annum. Under this authority, contracts at that rate were made with 42 consumers—mostly managers of theatres, hotels, railroads, newspapers, and large retail stores—by which, in consideration of this concession, they bound themselves to purchase gas of the Company exclusively for the period named. All these contracts expired on or about Jan. 1, 1891; but the Company continued to

supply these parties with gas at $1 per 1000 cubic feet until the 1st of January, 1892, at which time the price was advanced to $1·30. These consumers, in the year 1891, paid for 124,394,300 cubic feet of gas $124,394·30. With the rate of $1·30, and the same consumption, the bills would amount to $161,712·59—an increase of $37,318·29. On Nov. 28, 1887, the Directors decided that, from and after Jan. 1, 1888, a reduction of 10c. per 1000 cubic feet should be allowed to consumers whose bills were between $1000 and $2000 per annum. On April 10, 1889, it was voted "that the rebate of 10c. per 1000 feet allowed to large consumers be continued for the present." No other action has been taken with reference to this rebate. The last payments under these votes were made on March 24, 1891, for the consumption of 1890, at which time 54 consumers received rebates amounting to $7569·42.

Referring to the first part of the third question, the Commissioners reported that the Bay State Gas Company of Massachusetts have laid, at their works and in the streets of the city, 15 miles 3070 feet of mains, varying in diameter from 30-inch down to 4-inch. In the opinion of the Board, a fair estimate for the cost of these pipes is about $208,500. On or about July 1, 1889, the Boston Gas Company began to use 24-inch and 12-inch pipes for the purpose of sending gas into the city. Late in October of the same year, they began to use 30-inch pipe from their works to Shawmut Avenue. Only a small portion of the 4-inch, 6-inch, and 10-inch pipes have been used by the Boston Company; and for this they paid to the Bay State Company $100,000 on Dec. 20, 1889, for the year 1889, and $100,000 on Oct. 31, 1890, for the year 1890—making a total of $200,000. Some question has arisen in reference to this last item; and there is some confusion in regard to it in the books of the Boston Company. The cash-book of the Company shows that on Oct. 1, 1890, a sum of $100,000 was paid to the Bay State Company for the use of mains; and this amount was immediately charged to profit and loss. On June 30, 1891, the entire amount was taken out of profit and loss, and charged to a new account—"Rent of mains"—opened for the purpose, on the ground that the rental was for two years, and that the previous charge of this sum to profit and loss was an error. In the return to the Board, under date of June 30, 1891, the full sum of $100,000 was included in the assets of the Boston Company, as though the payment had been made for a use to be enjoyed at some period wholly subsequent to that date; but it was not shown as a liability in the return of the Bay State Company. This sum also appears, in the same way, in the balance-sheet of the Boston Company of Dec. 31, 1891; but not in that of the Bay State Company of that date. The entries of this transaction in the accounts of the latter give no indication of the period for which the money was received; but the receipt for the $100,000 filed with the vouchers of the Boston Company, and the records of the meetings of the Directors of both corporations, state clearly that this sum was in payment for the use of mains in 1890.

In relation to the purchases of gas referred to in the last part of the third question, the Commissioners reported: The Boston Gaslight Company have purchased from the Bay State Gas Company of Massachusetts, at $1 per 1000 cubic feet, as follows:—

	Cubic Feet.		Value.
Jan. 1 to June 30, 1890	84,285,000	..	$84,285
July 1 to Dec. 31, 1890	306,446,000	..	306,446
Total for the year, 1890.	390,731,000	..	$390,731
Jan. 1 to June 30, 1891	319,038,000	..	$319,038
July 1 to Dec. 31, 1891	470,326,000	..	470,326
Total for the year, 1891.	789,364,000	..	$789,364
The accounts show a rebate for gas bought during the last six months of			70,000
Making the cost for that period 85·7c. per 1000 cub. feet, and the net expenditure for the year			$719,364
Year 1892.	Cubic Feet.		Value.
Month of January	91,821,000	..	$91,821
Month of February.	76,708,000	..	76,708
Total for two months	168,529,000	..	$168,529
This expenditure exceeds that of the first two months of last year by.			37,181

These prices were for the gas delivered in the mains of the Bay State Company leading to the works of the Boston Company, in whose holders it was stored. If this gas had been made at the Boston Company's works, its cost should not have exceeded 55c. per 1000 feet.

In replying to the fourth queston, the Commissioners say: A strict construction of the term "surplus earnings" would probably include only that sum which remained after all the expenditure had been met, including interest and dividend charges. Upon this meaning of the term, it appears that all such earnings have remained in the possession of the Boston Gaslight Company, invested in its works or employed in the ordinary conduct of its business. The Board has assumed that the inquiry was designed to have a broader scope, and to include all those funds of the Company which may have passed from it to the Bay State Company of Delaware through the Bay State Company of Massachusetts, but to exclude any sums which may have passed otherwise, directly or indirectly, to the Delaware Company. As the income of the Bay State Company of Massachusetts has been derived almost exclusively from its transactions with the Boston Company, it is fair to say that practically its entire profits are from the earnings of the latter Company. The Board has therefore endeavoured to answer the inquiry by ascertaining what portion of these profits has been paid to the Bay State Company of Delaware. Some time in the year 1885, the Bay State Company of Massachusetts, by authority of the Directors, executed and delivered in part payment for the works or plant to be thereafter constructed, a bond or written obligation dated March 11 of that year, for $4,500,000. By the terms of this obligation, interest must be paid on this sum as often as once in six months from its date, at a rate equal to nine-tenths of the net profits of the business of the Bay State Company. For this reason the Directors have found it necessary, when declaring a dividend upon the $500,000 of stock, to declare interest at the same rate on the $4,500,000 bond. The Bay State Company of Delaware is not a holder of stock in the Bay State Company of Massachusetts; but by assignment dated Aug. 13, 1889, it became the sole owner of the bond, and all payments of interest have been made directly to the former corporation. Interest has been declared on this bond to the amount of $315,000 for the year 1890, $360,000 for the year 1891, and $112,500 for the portion of 1892 up to March 14; making a total of $787,500. Cash payments on account of this interest have been made to the amount of $780,310·50; leaving a balance unpaid of $7,189·50. So far as the Board is aware, no other earnings of the Boston Company have passed through the Bay State Company of Massachusetts to the Bay State Company of Delaware.

Proceeding next to deal with the question of price (the second subject in the order), the Commissioners point out that it is one of much difficulty, demanding for its full and fair consideration a large amount of careful investigation. The price at which gas can be supplied, whether in the holder or at the meter, is not, they remark, a fixed and obvious one, in every place the same; but many items of expense are so affected by local conditions and the volume of the business, that it is impossible to exactly determine at what price a company can make and supply gas, without an intelligent and exhaustive examination of all its affairs. With regard to the company specially concerned, they say: The Boston Gaslight Company disburses annually nearly $2,000,000 in many thousand transactions; and from computations based on the statements in the sworn returns made to this Board by the Boston Company, for the year ending June 30, 1891, it appears that it cost for coal, 36·27c. per 1000 cubic feet. Reducing this by the amount received from residual products, 13·09c., leaves 23·18c. per 1000 cubic feet for the cost of coal. The amount of the other items making up the cost in the holder—including enrichers, purification, wages at works and repairs, was 36·8c.; giving a total of almost 60c. for the cost of gas in the holder. For the cost from the holder to the consumer's meter, including wages, main and meter repairs, Directors' allowances, salaries, office expenses, taxes, claims, law expenses, and incidentals, the amount was 21c.; making 81c. To this sum should be added about 5 per cent. of the cost in the holder for gas which is used in carrying on the business, and that which is invariably lost in the process of distribution (commonly known as leakage, or unaccounted-for gas); making a total of 84c. In the opinion of the Board, this amount is too large; and may readily be reduced without embarrassment to the Company. In the spring or early summer of 1890, the Boston Company abandoned its former custom of buying coal directly from coal companies, or their regular agents, and has since then (with the exception of something like 1000 tons bought of the Dorchester Gas Company) purchased exclusively of the Bay State Gas Company of Delaware, at what seems to be a uniform advance over the market price, and adding, for the year to June 30, 1891, about $33,700 to the cost, or about 4c. per 1000 cubic feet to the cost in the holder. A different treatment of the residual products would probably increase the revenue from this source, and correspondingly reduce the cost of the gas. During the year mentioned, all the tar sold from the North End station was marketed by the Bay State Company of Massachusetts, at a profit to that Company of about $8000, or 1c. per 1000 cubic feet. An important item in the 36·8c. mentioned above is that of enrichers or oil. The experience of other companies would indicate that a reduction of 2c. per 1000 cubic feet might be made in this item. No special investigation has been made of the other items looking to a reduction. Deducting from the 84c. mentioned as the cost at the consumer's meter, the 7c. just referred to, leaves 77c.; and taking the same amount (7c.) from the 60c., leaves 53c. as a fair estimate of the cost in the holder. The proper amount needed to provide for renewals and extensions is perhaps the most difficult of all to accurately determine, and the one concerning which opinions would differ most widely. Very much depends upon the present condition of the plant for generating and distributing, the change of population and output, and all the engineering details of the business.

The Commissioners, dealing further with this part of the subject, close their report as follows: Very valuable suggestions may be gathered from the recent history of the Company. During the fifteen years beginning with 1877, the charges against income, for extensions and improvements, have somewhat exceeded $3,300,000, or an average annual charge of about $225,000—a little less than 16c. per 1000 cubic feet on the present output of the Company. But the period named was one of extraordinary development; it witnessed the construction of the entire works at Commercial Point, with large expenditure for new mains, and a payment for a part of the land at the Point. No such extraordinary expense seems likely to be called for in the next ten years. If the annual output should be doubled, no additional land purchase would be necessary. Fair provision could be made for extensions and renewals with one-half the sum named above, or 8c. per 1000 cubic feet. The capital of the Company ($2,500,000) equals $1·77 per 1000 cubic feet of output; and 8 per cent. on this may be stated at 15c. per 1000 cubic feet. Adding these amounts to the 77c. estimated to cover other items, we have $1 as a fair price at which gas may be delivered at the consumer's meter upon the conditions described. The detailed figures given are based upon an annual output of about 1414 million cubic feet. If, for any reason, the Boston Company should find it necessary to decline to supply the Roxbury and Dorchester Companies, the cost of distribution would be increased about 6c. because of the reduction in the output. Neither the fact of the purchase of gas from the Bay State Company of Massachusetts nor the price paid to that Company has been considered in these estimates. If the Boston Company were to continue to supply the Roxbury and Dorchester Companies without purchasing from the Bay State Company, it would be necessary to very soon increase the capacity of the Commercial Point station at considerable expense. If a water-gas plant were built (for which the Company now owns the rights), the cost of the mixed gas might be somewhat less than the above estimates.

Electric Lighting for Oldham.—The Oldham Town Council have adopted a scheme, proposed by Professor Kennedy, for the supply of electricity in the borough for lighting purposes.

THE NORTH BIERLEY GAS COMPANY AND THEIR STOKERS.

A case which came before the West Riding Bench at Bradford last Thursday week seems to indicate that the North Bierley Gas Company have recently been having some trouble with their stokers. The action was brought by a stoker named Johnson, who sued the Company under the Employers' and Workmen's Act, for one week's wages in lieu of a week's notice, to which he contended he was entitled. The amount claimed was £1 16s. 9d.; being at the rate of 5s. 3d. per day. From the evidence adduced for the plaintiff, it appeared that he was dismissed on the 10th of February last without any notice being given to him, for alleged misconduct on his part in not doing a full share of work in producing gas, he being employed with others on the night turn. The specific charge alleged against him was that he had only filled into the retort 18 shovelfuls of coal instead of from 28 to 30, which, it was contended, was the proper quantity. Mr. Ward, for the plaintiff, argued that the standard laid down by the Company was impossible; it was more a matter of judgment with the stoker when a retort was properly charged. No complaint had been made to the plaintiff as to any default in his work until he was sent about his business; and not a day's notice was given him, although, under his engagement, he was entitled to seven days' notice, and he now claimed for that term. Witnesses, including several of the plaintiff's fellow-workmen, were called to prove that the work had been properly done. Mr. Theobald, the Branch Secretary of the Gas Workers' Union, also gave evidence, and stated that when he went to see Mr. W. Oldfield, the Company's Manager, as to the cause of the plaintiff's dismissal, he told him that Johnson was one of the best workmen he had. He, however, charged him with only throwing 18 shovelfuls of coal into the retort. Mr. Wright, for the Company, stated that for some days prior to the 10th of February, the quantity of gas produced by the night turn had fallen short by 4000 to 8000 cubic feet. It was in consequence of this that the Manager watched the stokers; and this proceeding led to the dismissal of Johnson. Since his discharge, the full minimum quantity of gas had been made by the night shift. Mr. Oldfield gave confirmatory evidence. In cross-examination, Mr. Ward elicited the fact that during the month of February, after the plaintiff was dismissed, the quantity of gas produced by the night shift had fallen short on several occasions, ranging from 4000 to 9000 cubic feet. Eventually, the Bench dismissed the summons.

ELECTRIC LIGHTING FOR WORCESTER.

A recommendation of the Watch Committee that the tender of the Brush Electrical Engineering Company for lighting the city at a cost of £19,970 should be adopted, and that application should be made to the Local Government Board for their sanction to a loan of £40,000 (repayable in 30 years) for the purpose, gave rise to considerable discussion at the last monthly meeting of the Worcester City Council

At the outset, it was suggested by the Mayor (Mr. W. Holland) that the members should first hear the Engineer of the Brush Company (Mr. Raworth), then the Engineer of the Storeage Electrical Power Company (Mr. King), and then Mr. Preece, who had been consulted by the Committee. This suggestion having been adopted, Mr. Raworth commenced his remarks by referring to some of the objections which had been made to the system he advocated. He found that it was assumed that their alternating current system was something like the system worked by Mr. Ferranti at Deptford, which began at 10,000 volts, was transformed to 2400 volts, and went to the premises of the consumers, transformed to 100 volts. The Brush system would commence at 2000 volts, when brought into the heart of the town, and transformed to 100 volts; being kept to a low-tension system or network which was distributed over the whole town. One great advantage of the alternating-current system was that they could stretch out the arms of the main in any direction, to almost any extent, within a radius of two or three miles, without having any serious loss or alteration in the system. Mr. King then addressed the Council on behalf of the Electrical Storeage Power Company. He said that the system he advocated was in operation in more than one place; and in Chelsea it had worked for three years without the smallest hitch or trouble, except during the period of abnormal fog, when the power fell so as to afford some of the consumers who were scientific men reason for objecting to the fall of pressure below that specified by the Board of Trade. Their arrangements to prevent high pressure passing through consumers' wires was perfect. In the course of Mr. Preece's remarks, he said he could see no reason against the acceptance of the lowest tender—that of the Brush Company. He thought that very likely he should have said precisely the same if the tender of the Storeage Company had been at the bottom of the list. There was a great deal of "tweedledum and tweedledee" about the arguments the two gentlemen had been urging—both systems were admirable, and were equally adapted for working in Worcester. He swept away what he regarded as the silly and childish objection to the introduction of the electric light—the question of danger. Since the Board of Trade had taken in hand the regulation of the electric light, the inspecting officer had only had to inquire into two accidents—at Brighton and Chatham. He showed how both cases occurred; and remarked that it was not likely anything of the kind would happen in Worcester. He found that of 56 central stations, 30 were worked at high pressure and 26 at low pressure; and of the 30, 28 were on the alternate-current system. As to water power, there was at hand a magnificent supply, which was shown by the figures of the Surveyor to be continuous. But supposing they did not use it, the Brush Company gave an alternative tender. Assuming the central station was not placed at the weir, it would be situated in the town. The tender would then be reduced from £21,065 to £15,980; but, on the other hand, the cost of working was raised. In reply to a question, Mr. Preece said he estimated the revenue per lamp at 9s. In answer to a member, Mr. Raworth stated that the cost of working the Brush system without using water power would probably be raised from £3150 to £4200, as against £3690, the cost of the storeage system. Among other questions was one inquiring if the electric light would be an economical method for the streets if they did not get any domestic consumption; and to this Mr. Preece replied that it would cost more than gas. At the close of the discussion, Alderman Hill moved—"That, subject to obtaining the sanction of the Local Government Board to the requisite loan, this Council is in favour of accepting the tender of the Brush Electric Company, Limited, for applying electric light to the city; but delays the actual acceptance of the tender pending the receipt of a report from the Watch Committee as to the portion of the tender which should be accepted, and especially as to: (1) Whether provision should be made for steam power only, or steam and water power combined; and (2) should provision be made for street lighting." Mr. Williamson seconded the motion; and afterwards Mr. Millington proposed, as an amendment, "That the Council be supplied with copies of the tenders of the Brush Company and the Electrical Supply Power Company." This was seconded; and then Mr. Price pointed to the fact that at Barnet and Leamington the electric light had proved a financial failure. On the amendment being put to the vote, 21 members were in favour of it and 16 opposed it. Further discussion ensued; and then Mr. Millington's proposition was amended to read as follows, and in this form was carried—"That copies of the tenders sent in by the Brush Electrical Engineering Company and the Electric Power Storeage Company, but excluding the accompanying plans and drawings, be printed and circulated amongst the members of the Council; and that Mr. Preece be requested to submit at the next meeting a report on the comparative cost of production and distribution of electricity on the alternate-current and storeage systems, illustrated by particulars of the cost in other towns, including Bradford and Newcastle-on-Tyne." Mr. Matthews subsequently moved that the Town Clerk be instructed to obtain a list of the members of the Corporation who hold shares in the Worcester Gas Company; but the motion was defeated.

The Lighting of Rio de Janeiro.—The cost of lighting the streets of Rio de Janeiro last year was $1,081,130, against $856,047 in 1890. The lighting of the public gardens involved an expenditure of $12,209, as compared with $7961; and that of the public departments, $271,594, as against $179,043.

Arundel Gas Company.—The accounts presented at the recent annual meeting of this Company showed a balance of £714; and a dividend of 10 per cent. on the old capital, and of 7½ per cent. on the new was declared. It was stated that the Directors contemplated making some improvements at the works.

Preston and the Electric Light.—The temporary installation of electric lighting at Preston is giving way to a permanent one, with underground conductors, which are now being laid along some of the principal streets. Messrs. Latimer Clark, Muirhead, and Co. are putting down the plant. The central station will contain ten engines and dynamos and five boilers, providing power for the lighting of 50,000 8-candle lamps. The pressure on the mains will be 200 volts; entering the consumer's premises at 100 volts. The installation will, it is expected, be complete by August.

Anglo-Romano Gas Company.—At the general meeting of this Company, recently held in Rome, a dividend of 12 per cent. was declared for the year 1891; the profits having amounted to £77,185. The quantity of gas sold last year was about 388 million cubic feet to the public, and about 132 million cubic feet to the town. With reference to the electrical branch of the undertaking, in 1891 the Company laid down 775 yards of large primary underground cables, 1383 yards of secondary road cables, 9 transformers, and 31 meters; making a total at the end of the year of about 22,500 yards of primary cables, and 4968 yards of secondary cables, 152 transformers, and 109 meters. Current was supplied to 353 arc lamps and 12,360 incandescent lamps; but the electric plant of the Cerchi could easily supply the current for a further 10,000 lamps without much extra expenditure. There has been a considerable reduction in the cost of producing the current; and the profits have thus amounted to £7800, or about £2000 more than in the previous year. The transmission of the power from Tivoli to Rome has been delayed for several reasons. A number of improvements have been introduced into this work, the outlay on which so far amounts to £50,000.

Monte Video Water-Works Company, Limited.—The report of the Directors of this Company for the past year, which has been issued in view of the general meeting of shareholders next Thursday, states that the gross revenue amounted to £78,876—a decrease of £7655, entirely due to the reduced amount received from the Government for subvention, the receipts from this source being £3888, against £11,730 in 1890. The working expenses show a decrease of £2214; and the net income amounted to £47,687, against £53,128. After providing for interest and other charges, and adding £2046 to the fund for the renewal of buildings and plant, there remains an available balance of £22,257. An interim dividend of 2½ per cent. was paid on Nov. 1 last, absorbing £10,000; and the Directors recommend a further dividend of 2½ per cent. (making 5 per cent., tax free, for the year), and carrying forward £2256. The exclusive character of the Company's concession expired in March, 1891, and with it terminated the Government subvention of $4600 per month. Negotiations have been entered into with the authorities for a new concession; and a provisional arrangement has been arrived at under which the Company retain all the rights and privileges granted by the original concession, with the exception that the subvention is reduced from $4600 to $500 per month. The new subvention, at the rate of $500 per month, has been duly received in respect of the nine months from April to December, 1891, and has been credited to revenue account. The works in progress at the date of the previous report—viz., further additions to the filtration works at St. Lucia, a new covered storeage reservoir with a capacity of 3½ million gallons at Las Piedras, and important additions to the mains—have now been completed; and the results are stated to be most satisfactory. The past year was one of great depression in Monte Video; and there was a considerable falling off in the number of new houses built. This has naturally checked for a time the expansion of the Company's business; but it is gratifying to note that the ordinary revenue does not show any sign of reduction.

METROPOLIS WATER SUPPLY.

The Quality of the Water in March.

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the past month, show that the average daily supply was 181,507,050 gallons, as compared with 173,356,318 gallons in the corresponding month of 1891; being at the rate of 29·7 gallons per head of the population. Of the entire bulk of water sent out, 90,642,303 gallons were drawn from the Thames, and 90,864,747 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: "Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent, 0·8; New River, 1·3; Colne Valley, Tottenham, and East London (deep-well), 1·4; East London (river supply), 2·6; Chelsea, 2·7; West Middlesex, 2·8; Grand Junction, 3·0; Southwark and Lambeth, 3·3. The water abstracted from the Thames by the Chelsea, West Middlesex, Southwark, Grand Junction, and Lambeth Companies maintained the improved quality which it attained in February. It was efficiently filtered in all cases. The water taken chiefly from the Lea by the New River Company ranked with the deep-well waters as regards organic purity; while that supplied from the same source, but lower down the stream, by the East London Company, was superior to the best of the Thames waters. Both waters were efficiently filtered. The deep-well waters of the Kent, Colne Valley, and East London Companies, and of the Tottenham Local Board of Health, were of good quality for dietetic use; that of the Kent Company being specially distinguished for its excellence. The Colne Valley Company's water, having been softened before delivery, was rendered suitable for washing. All these waters were clear and bright without filtration. Seen through a stratum 2 feet deep, the Kent, Colne Valley, Tottenham, and East London (deep well) waters were clear and colourless; the New River was clear and nearly colourless; and the remaining waters were clear and very pale yellow. The bacteriological examination by Dr. Koch's process of gelatine plate culture, gave the following results: One cubic centimetre of each water, collected on the same days as the samples for chemical analysis, developed the following numbers of colonies of microbes: West Middlesex, 22; New River, 24; Kent, 30; East London (river supply), 44; Chelsea, 56; Grand Junction, 60; Lambeth, 72; and Southwark, 156.

THE GLAMORGAN COUNTY COUNCIL AND THE BIRMINGHAM WATER BILL.

At a Special Meeting of the Glamorgan County Council at Pontypridd last Thursday week, Sir Hussey Vivian, M.P., who presided, said he should have been very glad indeed had he been able to ask the Council to sanction an opposition to the Birmingham water scheme. He regarded it with real dread; for he considered that the population in that county would hereafter increase enormously, as they had so increased in the past. It should be borne in mind that the population of Glamorganshire at the commencement of this century was 71,000; and now it was 687,000. If it had increased in that enormous ratio, what would it be a hundred years hence, or even fifty years hence, and where would they get their water from? He could only see that they could get it from the high grounds of Breconshire and Radnorshire, and perhaps in Cardiganshire—at any rate from the watershed which belonged by nature to the Bristol Channel, and to the population along the border of the Bristol Channel. If they did not now safeguard their water, then future generations would rightly and properly blame them for allowing great populations like Birmingham and London to come and take it away. He was told by the Clerk that, unless proper notice was given to the Council of their intention to oppose the Bill, they could not spend any money for such a purpose. If the Council passed a resolution that a petition be lodged against the Bill, if not with the Commons, then with the Lords, he could be requested to give evidence; and he would be very happy indeed to do so. The only course for the Council to adopt, if they did resolve to petition, would be to adjourn the meeting, so as to give proper notice to authorize the Council to oppose. Alderman Charles then moved—"That a petition be presented on behalf of this Council against the Birmingham Water Bill, and that a special meeting of the Council be held upon a convenient date to sanction the payment out of the county funds of the costs of opposing the said Bill." Mr. James seconded the motion, and suggested that, by opposing the Bill, they might secure the insertion in it of a clause safeguarding the rights of the inhabitants of the Principality to a supply of water for the area prescribed. The resolution was adopted; and it was further resolved that the Clerk should communicate with other County Councils in Wales with a view of securing united action in the matter.

PLYMOUTH CORPORATION WATER SUPPLY.

The Proposed New Works.

A Special Meeting of the Plymouth Borough Council was lately held to consider the proposed scheme of the Water Committee for the conservation of the borough water supply. Mr. J. T. Bond, Chairman of the Committee, in moving that they be authorized to give effect to the recommendations contained in their report (an abstract of which was given in these columns last week), asked the members to boldly declare themselves in favour of the Burrator site, and loyally sustain the Committee in their determination to carry the scheme through. It was, they were convinced, the best and wisest policy. As to the cost, he had no objection to take it at £150,000; but he had a very strong opinion that it would be considerably less. There was, for instance, £30,000 put down as cost of easements, land, and parliamentary expenses; and this, he believed, was a most generous estimate. The population of Plymouth was 84,179; its rateable value, £309,000; its capital expenditure on water, £110,000; its total indebtedness on capital account for all purposes, £264,020, or £3 2s. 9d. per head; and rates amounting to 5s. 10d. in the pound. With regard to how they intended to meet the cost of the scheme, the amount they would require at the outside calculation of £150,000, repayable in 60 years, would be £5750 per annum. The repayments on the Guildhall would cease next year, which would give them £1500 a year to deal with. Then there were the old-bonded debts, the repayment of which they had been making to the tune of £3000 a year; and out of this it was thought they could take £2000. Then it was calculated that six years hence the water revenue would have increased by £2000. If they gave the manufacturers a constant supply of water, there would also be an additional consumption, without interfering with the question of rates at all, amounting to £250 a year, which would bring the amount up to the figure he had quoted as a sufficient yearly sum to discharge the cost of the proposed work and interest in 60 years. In times gone by, they had suffered from blizzards in the winter, and from constantly recurring periods of want of water in the summer; and in this scheme they had the remedy for these things. The town demanded that the water problem should be solved, and that no further delay should take place. He contended that before them was a scheme wise in its conception and sound in its conclusions; and he complimented the Engineer (Mr. Sandeman) on the fact that his project had received approval from such high authorities as those whose opinion had been sought. Mr. Alderman John Shelly, in seconding the motion, expressed the hope that the members would approach the Committee's proposals with a very strong feeling in their favour. The Council had for a long time recognized the absolute necessity of having a storeage reservoir; and its necessity and urgency had greatly increased, and were still increasing. Considerable discussion followed, in the course of which the Committee were advised to be cautious and not in too great a hurry, but no objection to the scheme was raised. The result of the voting was that the motion was carried *nem. con.*; four members abstaining from voting.

Midland Railway Company and Electric Lighting.—The Midland Railway Company are about to introduce the electric light into all their offices at Derby, and also the Midland Hotel. The installation will cost about £11,000.

The Todmorden Local Board and the Gas-Works.—It is stated that an arrangement has been entered into between the Todmorden Local Board and the Gas Company for the transfer of the gas-works; and the matter will shortly come before the ratepayers for confirmation or otherwise.

The Rowley Regis Local Board and the Gas-Works.—A report was presented at the annual meeting of the Rowley Regis Local Board last week by the Public Works Committee, in which they recommended the Board to take into consideration the acquisition of the gas undertaking. The report was adopted.

Formby Gas Company.—The annual report of the Directors of this Company states that the net profit for the past year, after the payment of all the working expenses and interest, amounted to £542, which, with the balance brought forward, made a total of £619. Out of this the Directors recommended the payment of a dividend (free of income-tax) at the rate of 5 per cent. per annum. The gross receipts for the year from the sales of gas and residual products came to £1788, as against £1571 in the previous year.

The Gateshead Town Council and the Water Company's Bill.—A special meeting of the Gateshead Town Council was held last Friday to consider certain matters relating to the Bill of the Newcastle and Gateshead Water Company to sanction the construction of new works on the Rede to provide the district with a larger supply of water than can be furnished at the present time. It was stated that the Bill had not been brought before Parliament within the time specified in the Standing Orders of the House, and that the opponents of the Bill were taking advantage of this omission and seeking to get it put back. In the interests of the district, it was urged that the oversight should not be allowed to act as a bar to the progress of the Bill; and it was decided that the Council, along with others, should petition the House of Commons to dispense with the Standing Orders in this case.

The Public Lighting of Bideford.—The Bideford Local Board last Thursday week had a discussion on the question of entering into a fresh contract with the Gas Company for the public lighting. On the Company's tender being opened, Mr. Restarick said it would be very unwise to accept a tender for lighting by gas for anything like three years. There was a great desire in the town for the electric light; and the Lighting Committee should get information as to the cost, &c., of providing an installation. Mr. Poland moved that the Gas Company's tender be accepted for one year only. He, however, saw no reason why the Board should not erect gas-works of their own. The Council had made the Company what he considered a splendid offer for their concern; but unfortunately no arrangement had been come to. The Company's Provisional Order was opposed; and the Council, if they thought fit, could carry the matter to a Parliamentary Committee. The Chairman observed that the Lighting Committee had met several times, but were as yet unable to report anything definite. Mr. Clements seconded the motion; remarking that it would be unwise to enter into a contract with the Company for more than a year, having regard to the proposals for lighting the town with electricity. Mr. Squire moved, as an amendment, that no tender be accepted until the negotiations going on between the Company and the Lighting Committee were fully understood. Mr. Braund seconded the amendment. Mr. Restarick remarked that there was great reason for dissatisfaction in the matter of the gas supply. The Council were anxious some time ago to buy the Company's works, and have the lighting of the town in their own hands. The negotiations had fallen through; the Company not giving the Council sufficient time to consider the matter. On being put to the vote, the amendment was carried.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Reverting to the remarks of Mr. J. Hall, of St. Andrews, at the informal meeting of gas managers in Glasgow on the 14th inst., upon the subject of the education of young men, and the granting of bursaries to those who study gas making in a scientific manner, one or two reflections may be stated. Mr. Hall thought it strange there should be no bursary in connection with the North British Association of Gas Managers, which would put it in the power of some young man to acquire an education in chemistry, "so that they might have established at some of their colleges an analyst that they could depend upon, and who could assist small gas companies in having an analysis." The latter part of the proposal would be an excellent thing for the companies. There are many small gas companies who have not the means of having coal analyzed; and if the Association could provide this, much benefit to them might ensue. The difficulty would be in the working out of any such scheme. If such a gentleman were found, he would, on the one hand, either be a permanent official, who would hold office during his lifetime, whether he gave satisfaction or not, or he would be a man of ambitious turn of mind who, as soon as he had the offer of another situation, would accept it, and leave to the Association the trouble of selecting a successor. The work which such an official would do might thus be interrupted; and the benefits to be derived from the appointment would be largely lost. But there are serious drawbacks to the proposal. One of these is that the whole of the pecuniary benefit to be derived from the bursary fund would go to one person, who might or might not be helpful to the gas industry. Another is that the procuring of analyses is the interest of the companies more than of the managers; and any fund which the managers may raise should be applied so as to benefit themselves, and not their employers. "The greatest good to the greatest number" is a safe rule for the managers to follow in such a matter. The suggestion of the Chairman of the meeting (Mr. T. D. Hall), that the bursary might be applied in the education of the sons of gas managers or of young gas managers, was, in the light of the above rule, more to the point; but even it fails in this particular, that the son of a gas manager might not become himself a gas manager, and the outlay upon his education would be lost to the industry. The training of young gas managers is the correct idea, because money expended upon them would bring a return in the improvement of the industry. But the £300 which the Murdoch Memorial Fund Committee have in hand would do but little in this direction; and the suggestion of the Chairman's father (Mr. J. Hall), that coal and iron masters might be asked to subscribe to the fund, is worth taking up. If sufficient funds could be raised, I would say that it would be a good thing if a bursary, or scholarship, were established, which would be held by one person for three years; the holder to be obliged to study gas making scientifically during that time under regulations to be laid down, and to be free afterwards to promote his own interests. But as there is not likely to be sufficient funds for such a purpose, if I might be allowed to make a suggestion, I would say that the Murdoch Memorial Fund might be applied in this way: First of all, let the North British Association agree upon a manual of instruction in the elementary principles of gas making, and require the gentlemen who are already its members to instruct their assistants in the principles laid down in the manual, as well as in the practical work of gas manufacture. Then, at the annual meeting of the Association, the assistants who chose to enter might be examined by either a Committee of the Association, or by an examiner appointed by them; and certificates—prizes, if they could be afforded—would be granted to those who passed. The proceeds of the fund would be awarded to those managers who had been instrumental in obtaining passes for their assistants; or, if the funds permitted it, in remunerating all the managers who had been engaged in the tuition of their assistants. Such a scheme would confer benefit on both parties—on the assistants, who would receive the education, and on the managers, who would be remunerated for their trouble. I am led to make this suggestion because of my experience of another trade—the baking trade—which resembles that of gas manufacture, in being one which combines a little scientific with a large amount of practical knowledge. I know nothing of baking; but I attended last winter a course of lectures upon bread making in one of the Technical Colleges, and I was convinced, night by night, of the utter futility of employing merely scientific lecturers to instruct practical men. Unless for a very few, the severely scientific aspect of his occupation is thrown away upon either the gas manufacturer or the baker. It is the practical that is wanted; and the scientist cannot supply that. He deals in units and in formulæ which are bewildering to the ordinary worker. It is a significant indication of the weakness of the strictly "scientific" method of training that, at the close of the course of lectures alluded to, a master baker had to be asked to give a series of lessons on practical bread making before the class could be submitted for examination. It would be the same with gas making; and therefore I would suggest that instruction in the practical side of the subject should be the chief aim—such instruction as the ordinary gas manager is thoroughly capable of giving—and that assistants should be left to their own resources in furnishing themselves with whatever of science they may think they require. Having had the practical training, the more of the scientific they could command, and carry along with them, the better it would be for themselves. The ordinary man may do without much of the scientific, but without practical knowledge he would be useless; and I therefore submit this suggestion in the confidence that by it, or something like it, would be found the best means for the promotion of the important industry of gas manufacture.

The Corporation of Paisley, as owners of the gas undertaking, are in the position of having, on account of popular clamour, to take up questions connected with the gas supply, and to defend themselves. The town is extending, with the result that Mr. Hislop, having to send his gas farther afield and through mains which were laid to serve only the original smaller area, has had to fall back upon the expedient of putting on extra pressure. This, and the dark weather, led to the gas bills in the centre of the town being larger at the January survey; and the inevitable charge of bad gas or mismanagement was raised. A crop of complaints alleging overcharge sprang up rapidly; and these were sent to a Committee, whose report was submitted to the Town Council on Tuesday of last week. The Committee recommended the laying of larger mains in several parts of the town, at a cost of about £1000; and that the practice of gratuitously giving out burners suited to the gas should be resumed. In their opinion, the increase had been partly caused by those who had complained having changed their burners, substituting much larger sizes, which had led to a great increase in the consumption. The only cure is to educate consumers as to what is necessary for the particular gas which is supplied. This, the Gas Committee stated, they are prepared to do, provision being made for explaining and illustrating the principles by which consumers should be guided in both lighting and heating their houses by gas. The Committee's report was adopted. It is not difficult to see Mr. Hislop's hand in these arrangements. He is a strong advocate of the gratuitous supply of burners; but hitherto, except for a short period of eight months or so, somewhere about 1883, he has been unable to have his views carried out. On that occasion, some of the Corporation became alarmed at the cost; and the free supply of burners was stopped. Mr. Hislop has now the satisfaction of having been able to convince his employers that his view is the right one. It is an interesting move on the part of a large Corporation. I had almost called it an experiment; but, on second thoughts, I have no doubt that Mr. Hislop has thought out the whole subject so well that before it is begun, the step he is about to take is already beyond the stage of experiment, so far as Paisley is concerned. Mr. Hislop has received much sympathetic, but little practical, support in his proposals—only one or two small places having hitherto adopted the policy he advocates. Now that it has been placed in his own hands to demonstrate the feasibility of his scheme, let us wish him a free hand in the carrying of it into execution; and at the meeting of the North British Association of Gas Managers in 1893, there should be something interesting to listen to.

The Gourock Police Commissioners, as owners of the gas undertaking, have done what appears to be a foolish thing. When the railway was extended from Greenock to the town four years ago, the place suddenly became one of great activity, the larger portion of the coast traffic passing through it, with, as a matter of course, a considerable proportion of the passengers making a more or less extended stay in the burgh. That meant an increased consumption of gas; and the question, following upon it, of how to make provision for the demand. The Commissioners some time ago asked Mr. James M'Gilchrist, of Dumbarton, to report to them on what was necessary. Mr. M'Gilchrist is as practical a man, and as well acquainted with the requirements of Gourock, as anyone they could have employed. His report, submitted to the Commissioners on Monday recommended a re-arrangement of the works and several extensions and renewals, at an estimated cost of £2250, or including a new gasholder of from 100,000 to 130,000 cubic feet capacity, of £5250. The proposals were exceedingly moderate and fair, considering the rapid growth of the place; but the Commissioners appear to be a timid body of men, and "after a long discussion," they adopted in preference what appear to have been cheaper proposals by Mr. M'Ewan, their own Engineer. In a place like Gourock, where the output, though not very large, has increased by 3 million cubic feet in one year, the future is a more important factor than the present, which the Commissioners seemed not to realize. In their case, too, the debt upon the undertaking is small—only the mere trifle of about £8000; and both these considerations should have induced them, when they were in the way, to have made a thorough overhaul of the gas-works. It seemed to them otherwise, however; and they adopted local proposals, appointing Mr. Andrew Gillespie, consulting gas engineer, of Glasgow, to be the advising engineer. These proposals are presumably good enough so far as they go; it is in not going in for a thorough scheme of overhaul, that the Commissioners have adopted the policy which will probably be the most costly in the end.

There is a proposal to expend nearly £5000 upon the gas-works which belong to the Corporation of Wishaw. The town is not a very large one; but the consumption of gas has been advancing at the rate of some 2½ million cubic feet a year. Mr. M'Nair, the Gas Manager, suggests the re-building of the retort-house, and the constructing of the new house on Mr. G. R. Hislop's system of regenerative furnaces. He also proposes a new gasholder of 80,000 cubic feet capacity. The necessity for the proposed works was admitted by the Police Commissioners at a recent meeting; but they were not sufficiently informed on the finance question, and they took a fortnight to consider Mr. M'Nair's proposals before giving their sanction to them.

The lighting of common stairs, which has given so much trouble in Edinburgh, has been engaging the attention of the Police Commissioners of Partick, one of the suburban burghs of Glasgow. The burgh has no gas supply of its own, since the Partick, Hillhead, and Maryhill Gas-Works were taken over by the Corporation of Glasgow; and the situation arose that, whereas in Glasgow the cost of stair lighting is partly defrayed out of the rates, the same system could not be applied in Partick without arrangement with the Police Commissioners. The Commissioners having received a communication from the Gas Committee on the subject, consulted the ratepayers thereon; and the result was reported to be that the owners and occupiers of property in which 964 gas-jets are used gave their consent to the Commissioners lighting and extinguishing the lamps. The Commissioners resolved to undertake these; and the others who have not consented will have to come to terms with the Glasgow Gas Commissioners for a supply of gas, and to light and extinguish the lamps in their own properties.

The Board of Supervision are not satisfied with the report by the Medical Officer regarding the Fraserburgh Gas Company's works. They have written to the Police Commissioners pointing out that he altogether omitted from his report the necessary statement as to whether the works were "so conducted as to be offensive or injurious to health." If the Medical Officer is unable to certify as required by the Board of Supervision, it is not improbable that the Board may yet send down a man to make an examination for them; and it will depend upon his view of the situation whether or not the Gas Company get into trouble over the matter.

The water supply of Aberdeen, introduced so far back as about 1866, has been examined this week by Mr. J. M. Gale, of Glasgow, with a view to his reporting on the questions connected with the pollution

which affects the present supply, and on the sources of a prospective increase. Ever since a general system of water supply was introduced into Aberdeen, it has been derived from the River Dee—a stream which is frequently spoken of with the prefix "silvery," on account of the clearness of its waters. Originally, the supply was taken from the river at the old Bridge of Dee, about three miles from the sea; but the growth of the suburbs, with their attendant discharges of sewage into the river, led to the pumping-station being abandoned, and the present (which is a gravitation system) being substituted for it. The same causes have again operated. Since 1866, owing chiefly to the growth of health resorts upon the higher reaches of the river, pollution is again troubling; and the city also has grown very largely, and a supply of 8 million gallons per day is becoming perilously small. Mr. Gale spent Tuesday and Wednesday examining the river; and on Thursday he had a meeting with the Water Committee, at which he communicated some of the conclusions he had arrived at. On the subject of pollution, he is of opinion that the sewage from the towns and villages, which is at present drained into the river, should be dealt with by irrigation. Extensive pollution does exist; and he advises that the local authorities of the places where it arises should be compelled to either prevent it altogether, or adopt means to render the discharges innocuous. In the course of ten or fifteen years, he considers, it will be necessary to face the question of an increase to the water supply of the city; and he does not think the Town Council should contemplate anything less than the doubling of the present service. The river, he considers, should still be their source of supply; but they should go farther up with the point of abstraction, in order that they might get beyond, if possible, the sources of contamination, and in order to have a better pressure in the higher districts of the area of supply. In the meantime, he is of opinion the water should be filtered and the storeage should be increased, so as to be equal to three or four days' supply, in order that they might be able to shut out the river in times of flood. Were more water taken from the river, it would be necessary to provide compensation water; and in that connection, he had examined Loch Callater, in the hills above Braemar, about 70 miles from Aberdeen, and Loch Muick, about nine miles above Ballater and 50 miles from Aberdeen. Loch Callater would be unsuitable, because the drainage area is so small that not more than 7 million gallons per day could be got from it. Loch Muick, on the other hand, would suit admirably, provided its surface were raised 25 or 30 feet. The Committee, having heard Mr. Gale, instructed him to frame a report to them on the subject. They also resolved to seek an interview with the County Council on the subject of pollution, with a view to avoiding litigation. In this they are likely to be successful, as the County Council are as anxious as the City Council are to avoid polluting the river. Loch Muick is partly the property of Her Majesty. She possesses on its banks a small rustic dwelling, called a "shiel," in which she occasionally spends a couple of days and nights in that rural simplicity which she so much enjoys; and if the level of the loch were raised, it is probable that this favourite retreat of hers would have to be removed to another site.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 23.

Sulphate of Ammonia.—The market is without alteration; and there is a fair amount of business passing—not sufficient, however, to raise its tone. Hull quotations are at £10 3s. 9d. to £10 5s.; Leith, at £10 3s. 9d.; Liverpool, at £10 2s. 6d.; and the shipments indicate that the position remains perfectly sound. There is rather more continental inquiry; and especially summer and autumn deliveries are eagerly sought after. Makers are not sellers of "futures;" but it is reported that some of the speculators are taking orders. Nitrate is in fair demand; but prices are tending downward.

LONDON, *April* 23.

Tar Products.—The make of tar is now much reduced; and tar distillers are less anxious to sell than they were before the holidays. There is no improvement to report in any of the products; and with the exception of pitch, which is moving off against old contracts, practically no business is being done. A large quantity of creosote is being burnt as fuel at producers' works; and to this extent stocks are being relieved. Market prices may be taken to be: Tar, 10s. to 12s. Pitch, 28s. to 29s. Benzol, 90's, 1s. 7½d.; 50's, 1s. 4d. Toluol, 1s. 2½d. Solvent naphtha, 1s. 2d. Crude benzol naphtha, 30 per cent., 9½d. Creosote, ½d. Naphthalene salts, 20s.; pressed, 45s. Carbolic acid, crude, 60's, 1s. 1d.; 70's, 1s. 4½d.; crystals, 5d. Cresol, 8d. Anthracene, 30 per cent., "A" quality, 10½d.; "B," 7½d.

Sulphate of Ammonia.—Transactions have been noted at prices varying from £10 to £10 3s. 9d., less 3¾ per cent., and according to conditions and terms of delivery. The market is extremely dull, and the prospect not at all encouraging. The improvement which it was hoped would take place with the advent of better weather does not so far appear to have been realized. The season, however, is a late one; and home consumers may yet require considerable quantities. There does not seem to be much hope of the better prices which usually obtain at this season of the year. Gas liquor (10-oz.) is quoted at 5s. to 6s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Except that the protracted severe weather has been keeping up a fairly active demand for house-fire qualities, increasing quietness is generally reported throughout the coal trade of this district; and although the pits in most cases have been stopped for a longer period than usual for the Easter holidays, supplies are plentiful in all descriptions of fuel, with stocks accumulating. For the better qualities of round coal, prices are well maintained. Best Wigan Arley still averages 12s. 6d.; Pemberton four-feet and second qualities of Arley, 10s. 6d. to 11s.; and common house-fire coals, 9s. to 9s. 6d. per ton. Inferior qualities of round coal show, however, a weakening tendency, which is only to be expected, with the gradually decreasing requirements for iron making, and other coal-using industries. Renewals of contracts are already being taken at lower figures; and there seems every probability that there will be a keen competition for the usual contracts which will shortly come upon the market for supplies of gas and locomotive coals. At the pit mouth, steam and forge coals do not average more than 8s. to 8s. 6d. per ton; whilst for shipment, under these figures has been taken, owing to the increasing competition of Welsh coal, which has, during the past week, been considerably reduced in price. Delivered at the ports on the Mersey, good ordinary qualities of Lancashire steam coal are not averaging more than 9s. 6d.; whilst best Welsh steam coal is obtainable at 10s. 6d. per ton. Engine fuel is hanging upon the market, owing to the unsettled condition of the cotton trade; and although the better qualities are still fairly maintaining their price, inferior sorts are offering at low figures, and there is a good deal of competition with surplus supplies from other districts. At the pit mouth, good, ordinary qualities of burgy still average 6s. to 6s. 6d., and the best qualities of slack, 5s. to 5s. 6d.; but common slack can be bought readily at 3s. 6d. to 4s. per ton.

Northern Coal Trade.—The coal trade is still abnormally situated by the continuance of the Durham miners' strike. There is an import of coal from Scotland and from Yorkshire; and with a restriction of the consumption at the great works, there does not seem much scarcity. Northumbrian steam coal is, however, rather higher in price, as the season for exports is drawing near. For best qualities, about 11s. per ton f.o.b. is the current quotation; and the turns for delivery have been rather long. Second-class coals are 1s. per ton lower. Small steam coals are in demand for manufacturing purposes; and about 5s. per ton f.o.b. is the price. Gas coals are rather scarce, at 12s., less 2½ per cent.; but there are offers of supplies from Scotland at rather lower prices. Bunker coals are dull, in consequence of the large number of steamships laid idle both in the Tyne and in the Wear. Household coals are dull; the finer weather having lessened the consumption, whilst the supplies from the Yorkshire collieries are larger. Coke is very scarce, and as high as £1 per ton f.o.b. is asked for best qualities for export; but there are no sales of moment, and the deliveries are chiefly on old contracts at much lower rates. Gas coke is on the whole steady at the reduced rate; but the consumption seems most in the retail way. There are some indications that the long strike of the Durham miners is approaching its end; and its termination would be received with joy by all sections of the trading community in the country.

Scotch Coal Trade.—The demand for most varieties of coal is slackening, and prices have receded from the figure they reached on the outbreak of the miners' strike in Durham. This is, to some extent, accounted for by warmer weather setting in—the snow of the past week having all disappeared; but it is to a greater extent reaction following upon the laying in of stocks which sprang up when the "miners' play" was announced. Very little is being done in forward business—less than might have been expected, considering that the Baltic is being opened up. Owing to the distress in Russia, it is anticipated that money will be difficult to collect there; and there is less eagerness than usual to take up the few orders which have come. Scotch coal continues to be sent in considerable quantities to the North of England. The quotations in Glasgow last week were: Main, 7s. 9d.; ell, 8s. 6d. to 8s. 9d.; splint, 8s. 3d. to 8s. 9d.; and steam, 10s. 3d. to 10s. 6d.—all unchanged from the previous week.

Belgrano Gas Supply.—An arrangement has been come to by which the Belgrano (Buenos Ayres) Municipality will pay its debt to the Gas Company half in bonds and half in cash; and the price of gas will henceforth be increased 50 per cent.

City of St. Petersburg New Water-Works Company, Limited.—The Directors of this Company have received information from the Manager at St. Petersburg, that the Senate has decided in favour of the Company in the long-pending suit with the Municipality as to payment for meters.

Sale of Shares in the West Ham Gas Company.—In accordance with the announcement which has appeared in our advertisement columns during the past few weeks, Mr. Alfred Richards sold last Thursday, at the Auction Mart, Tokenhouse Yard, 1150 original (£10) 7 per cent. shares in the West Ham Gas Company. They were submitted to public competition by order of the Directors, under the provisions of the Company's Act of 1889. They were put up in lots of ten; the prices realized ranging from £11 10s. to £13 10s. per share.

Sulphate Plant for the Newcastle Gas-Works.—Mr. Maurice Schwab, of Manchester, is the successful competitor for the erection of new sulphate of ammonia apparatus for the Newcastle and Gateshead Gas Company. He has received instructions to erect plant to distil 70 tons of liquor per day each for the Elswick and Redheugh works. It will be fitted with the most modern improvements—Wilton's patent saturators and dischargers—and will be completely automatic in action. These appliances are, we learn, giving very satisfactory results; upwards of sixty of them being at work in the United Kingdom.

The New Water-Works for Northallerton.—The ceremony of cutting the first sod in connection with the Northallerton new water-works took place last Friday at Thimbleby, about 1½ miles from Osmotherley. The members and officials of the Local Board drove out in brakes to the site where the sod was cut by Mr. Charles Waistell, Chairman of the Board, who was presented with a silver spade, suitably inscribed. Mr. A. M. Fowler, of Manchester, the Engineer of the scheme supplied the following information relative to the new works: They were started about two years ago; the reservoir being situated some 6 miles from the town; the line of conduit, including the mains in the town, being about 7½ miles in length. The water is collected from several springs on the south side of Oakdale, and is collected into a small reservoir in the upper portions of the town, and from thence is conveyed to a service reservoir at Bullamoor, at an elevation of 218 feet. The capacity of these two reservoirs is 200,000 and 300,000 gallons respectively.

The Castleton (Derbyshire) Water-Works Company, Limited, has been registered with a capital of £2000, in £1 shares, to supply the village of Castleton with water, and generally to carry on the business of a water company.

Collapse of a Gasholder at Gillingham.—Last Thursday week, the side of a small gasholder gave way at the Gillingham (near Chatham) Gas-Works; and the whole of the gas it contained escaped. The holder was an old one, and has only been used occasionally for some time past. Fortunately no one suffered any ill-effects from the gas; and the consumers experienced little or no inconvenience.

Stafford Corporation Gas Supply.—Alderman W. H. Peach, the Chairman of the Gas Committee, presented a report at the last meeting of the Stafford Town Council, which showed that the gas consumed during the past year had been 123,000,000 cubic feet—an increase of 9,294,000 cubic feet over last year, or 9·42 per cent.—while the quality had been 18·15-candle power. The Chairman also stated that the railway siding was now in full working order, and the trucks were shunted into the works by the railway engines; and with this accommodation the Corporation would find considerable advantage and saving in the matter of haulage. It had also been decided to provide additional coal storeage, at an estimated cost of £350.

New Water-Works for Plympton.—Mr. S. J. Smith, C.E., one of the Inspectors of the Local Government Board, held an inquiry at Plympton a short time ago, into an application by the Sanitary Authority of the Rural Sanitary District of Plympton St. Mary Union for sanction to borrow the necessary money for works of water supply for the district. The scheme which it is proposed to carry out has been projected by Mr. B. J. Shiers, of Ilminster, who estimates that the cost will be £7242. Among the witnesses called in support of the scheme was Mr. H. Francis, the Manager of the Devonport Water Company, who said he computed the outlay at £7463. There was a large attendance of ratepayers, several of whom opposed the application.

The Reliability of Water-Meters.—An interesting case recently came before His Honour Judge Martineau and a jury at the Dorking County Court in which the Dorking Water Company sued Dr. T. W. King for £17 8s. 6d. for water supplied by meter. The defendant disputed the registration of the meter, and paid £8 5s. into Court. In the quarter ending March 24, 1891, the meter was said to have passed 26,250 gallons; and this he firmly believed to be incorrect, for during seven weeks of the quarter he was entirely without water, owing to frost, and in previous quarters he had not consumed half the amount. In consequence of Dr. King's complaint, the matter, it seems, was inquired into by Mr. Rossiter, the Managing Director of the Company. A new meter was fixed in place of the old one on Sept. 24; and it registered within three or four gallons of the same average daily consumption. On Oct. 31 the new meter had registered in seven days 3860 gallons, or 551 gallons per day. On Oct. 7 it registered 7180 gallons, or 553 gallons per day. On that day the water was turned off from the meter at 10.30 in the morning, and was not touched till 2.45; and it then appeared that the meter, which in the morning had registered 7180 gallons, had gone on to 7250 gallons—a difference of 70 gallons in four hours. The meter was fixed at Dr. King's front gates, and the pipe ran across the lawn. From the fact that the meter showed a consumption while the water was shut off from the house and stables, it was conjectured by the Company's officials that there was a leak between the meter and the house. Evidence was given by Dr. King and his servants; and they all declared that they had not detected signs of leakage. A plumber also stated that he had examined the service-pipe and internal fittings, and had found them all in good order. The jury gave a verdict to the effect that the meter was unreliable, and that the index had moved when no water passed. His Honour on this finding gave a verdict for the defendant, with costs; and refused leave to appeal.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

For Stock Market Intelligence, see ante, p. 744.)

Issue.	Share	When ex-Dividend.	Dividend on Issue.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d
590,000	10	13 Apr.	10½	Alliance & Dublin 10 p. c.	10	15½–16¾*	..	6 7 3
100,000	10	"	7½	Do. 7 p.c.	10	11–12*	..	6 5 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105–107	..	4 13 5
100,000	20	27 Nov.	8	Bahia, Limited	20	12–14	..	11 8 1
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½–7	+¼	5 5 9
40,000	5	"	7½	Do. New	4	4½–5¼	..	5 14 1
380,000	Stck.	26 Feb.	12½	Brentford Consolidated	100	210–215	..	5 14 1
150,000	"	"	9½	Do. New	100	158–163	..	5 13 5
220,000	20	11 Mar.	11½	Brighton & Hove Original	20	40–42	+1	5 9 6
888,500	Stck.	11 Mar.	5	Bristol	100	95–100	..	5 0 0
320,000	20	13 Apr.	11½	British	20	42–44*	..	5 2 3
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19–20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	14–15	..	5 13 4
328,750	10	—	—	Buenos Ayres (New) Limited	10	6½–7½	..	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	93–96	..	6 5 0
150,000	20	26 Feb.	8	Cagliari, Limited	20	24–26	..	6 3 1
550,000	Stck.	13 Apr.	13	Commercial, Old Stock	100	230–235*	–15	5 10 8
165,000	"	"	10	Do. New do.	100	185–190*	..	5 5 3
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118–123	..	3 13 2
800,000	Stck.	30 Dec.	13	Continental Union, Limited	100	221–226	..	5 15 1
200,000	"	"	10	Do. 7 p. c. Pref	100	185–195	..	5 2 7
75,000	Stck.	30 Mar.	10	Crystal Palace District	100	185–195	..	5 2 7
486,090	10	29 Jan.	10	European, Limited	10	19–20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	13½–14½	–½	5 3 11
5,470,820	Stck.	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	210–215	..	5 11 8
100,000	"	"	4	Do. B, 4 p. c. max.	100	94–97	..	4 2 5
665,000	"	"	10	Do. C, D, & E, 10 p.c. Pf.	100	245–250	..	4 0 0
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	116–121	..	4 2 9
80,000	"	"	7½	Do. G, 7½ p. c. do.	100	169–174	..	4 6 2
1,300,000	"	"	7	Do. H, 7 p. c. max	100	153–156	..	4 9 9
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	243–248	+2	4 0 8
476,000	"	"	—	Do. K, 6 p. c. Prf.	100	146–150	..	4 0 0
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	113–116	..	3 9 0
294,850	"	"	4½	Do. 4½ p. c. do.	100	118–123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do	100	163–168	..	3 11 5
3,800,000	Stck.	12 Nov.	12	Imperial Continental	100	224–228	..	5 5 3
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4–4½	..	6 13 4
560,000	100	1 Apr.	5	Met. of Melbourne, 5 p. c. Deb.	100	106–108	..	4 12 7
541,920	20	27 Nov.	6½	Monte Video, Limited	20	14½–15½	..	8 7 8
150,000	5	27 Nov.	10	Oriental, Limited	5	8–8½	–¼	5 17 8
60,000	5	30 Mar.	7	Ottoman, Limited	5	4–5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2–3	–½	—
				People's Gas of Chicago—				
420,000	100	3 Nov.	6	1st Mtg. Bds.	100	105–108	..	5 11 1
500,000	100	1 Dec.	6	2nd Do.	100	105–108	..	5 11 1
150,000	10	15 Oct.	10	San Paulo, Limited	10	8–9	–½	—
500,000	Stck.	26 Feb.	15½	South Metropolitan, A Stock	100	267–272	..	5 14 0
1,350,000	"	"	12	Do. B do.	100	220–225	..	5 6 8
200,000	"	"	13	Do. C do.	100	235–240	..	5 8 4
725,000	"	30 Dec.	5	Do. 5 p. c. Deb. Stk.	100	140–145	..	3 9 0
60,000	Stck.	11 Mar.	11½	Tottenham & Edm'nton, "A"	100	225–230	..	5 0 0
				WATER COMPANIES.				
729,331	Stck.	30 Dec.	10	Chelsea, Ordinary	100	248–253	+5	3 19 4
1,720,252	Stck.	13 Apr.	8	East London, Ordinary	100	193–198*	+1	4 0 10
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	136–140	..	3 4 3
700,000	50	11 Dec.	8	Grand Junction	50	96–99	+1	4 0 10
708,000	Stck.	12 Feb.	10½	Kent	100	250–255	+3	4 2 4
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	217–222	+4	4 5 7
406,200	100	"	7½	Do. 7½ p. c. max.	100	183–188	+1	3 19 9
260,000	Stck.	30 Mar.	4	Do. 4 p. c. Deb. Stk.	100	120–123	..	3 5 0
500,000	100	12 Feb.	12½	New River, New Shares	100	320–330	..	3 13 6
1,000,000	Stck.	29 Jan.	4	Do. 4 p. c. Deb. Stk	100	126–129	..	3 2 0
902,300	Stck.	30 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	145–150	+5	4 6 8
126,500	100	"	6½	Do. D 7½ p. c. do.	100	130–135	..	4 16 3
1,155,066	Stck.	11 Dec.	10	West Middlesex	100	240–245	..	4 1 7
						*Ex div.		

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES

Telegrams: "GWYNNEGRAM LONDON." **GWYNNE & CO.,** TELEPHONE No. 2698.

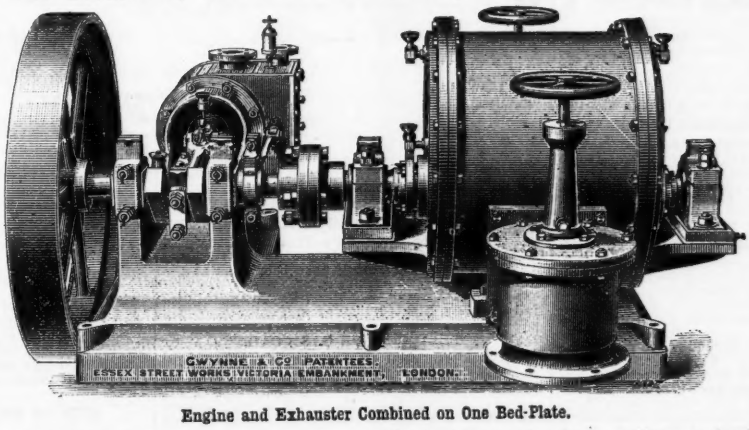
HYDRAULIC AND GAS ENGINEERS, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY' LIMITED.

ANDREW STEPHENSON, Agent.
Please address all communications to the Company, as above.

ANDREW STEPHENSON, Agent for BRIN'S OXYGEN COMPANY, Limited, Westminster, S.W.
City Address: 182, Gresham House, Old Broad Street, LONDON, E.C.

WINKELMANN'S "Volcanic" Fire CEMENT. (Fire resistance, 4500° Fahr.)
Prices, particulars, and directions for use on application to ANDREW STEPHENSON, 182, Gresham House, Old Broad Street, LONDON, E.C.

CANNEL COAL, ETC.

JOHN ROMANS & SON, EDINBURGH.
Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, } SCOTLAND.
NEWTON GRANGE, NEAR DALKEITH, }

OXIDE OF IRON FOR GAS PURIFICATION.

JAMES GORDON & Co., Brokers, can offer Cargoes of good quality; also 2500 tons of SPENT OXIDE.
Samples and price on application.
Address Borough Buildings, 7, Rumford Street, LIVERPOOL.

LIQUOR and Tar wanted.
BROTHERTON AND Co., Ammonia and Tar Distillers, LEEDS and WAKEFIELD.

LIQUID FUEL.

TAR Oils, Naphthalene, Oil Residues, Tar, Petroleum, &c. SADLER'S PATENT BURNER is the simplest and most effective. No smoke; no Ashes.
For particulars and price of Burner and Cheap Oils, apply to SADLER AND CO., LIMITED, MIDDLESBROUGH.

ADVERTISER requires a re-engagement as WORKING MANAGER in Gas-Works (can take entire charge), or CLERK OF WORKS in a Gas-Works. Over 25 years' experience.
Address T. VARLEY, Skelton Street, Colne, LANCASHIRE.

WANTED, by a young Man (age 23), a Situation as CLERK, COLLECTOR, &c., to a Water-Works Company. Good Writer, quick and accurate at Figures, and can read Indices of Meters. Seven years' experience in present Situation.
Address J. W. T., 3, Park Villas, Herne Street, near CANTERBURY.

WANTED, a steady young Man as GAS-FITTER, MAIN AND SERVICE LAYER, and to fix Cooking Stoves and Meters.
Apply, stating Wages required, &c., to the MANAGER, Gas-Works, Glastonbury, SOMERSET.

WANTED, a thorough Gas-Fitter, of good address, principally for internal work, and able to intelligently advise upon Burners, Globes, Fires, and all similar points. Wages, 30s. Constant employment to a good man.
Address Mr. F. G. DEXTER, Gas-Works, WINCHESTER.

GAS MANAGER (WORKING).

WANTED, a Manager to take sole charge of small Works. One accustomed to Iron Retorts, and able to fix Meters, Service-Pipes, Mains, set Retorts, &c. House, Coal, and Gas found.
Apply to Mr. NEVILLE DAY, Easton, near STAMFORD, stating Age, with References, &c.

CLERK OF WORKS.

THE Brighouse Local Board require the services of a competent Man, to act as CLERK OF THE WORKS during the erection of a Stone Retaining Wall next River Calder and Clifton Beck, and Wrought-Iron Annular Tank and Three-Lift Telescope Gasholder, required in the Extension of the Gas-Works.
The person appointed will be required to devote the whole of his time to the duties of the office.
Sealed applications, stating Age, Salary required, and giving full particulars of present and past engagements, accompanied by not more than three recent Testimonials as to character and ability, to be addressed to Fredk. Laxton, Esq., Chairman of the Local Board, Public Offices, Brighouse, on or before Friday, the 6th day of May, 1892, endorsed on the outside "Clerk of Works."

By order,
JAMES PARKINSON,
Clerk to the Board.

Public Offices, Brighouse,
April 14, 1892.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
***See Advertisement p. 778 of this week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock, Oldham."

TUBES.

FOR Gas, Steam, and Water; Galvanized, White Enamelled, and Hydraulic Tubes, &c.
JOHN SPENCER, Globe Tube Works, WEDNESBURY, and 14, Great St. Thomas Apostle, LONDON.

HUTCHINSON BROTHERS, Barnsley, Gas Engineers and Contractors, Makers of Wet and Dry Gas-Meters and General Gas Apparatus, Sulphate of Ammonia Plant, Lead Saturators, Tanks, &c., Tools and Sundries.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 70, Wellington Street, GLASGOW; 58, Fountain Street, MANCHESTER; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."

PATENTS, DESIGNS, AND TRADE MARKS.

INVENTIONS Protected by Letters Patent. TRADE MARKS REGISTERED at home and abroad. Advice on all questions relating to above. Handbook gratis.
Apply to J. C. CHAPMAN, Chartered Patent Agent, 70, Chancery Lane, LONDON.

COUNTY BOROUGH OF WIGAN.
(GAS DEPARTMENT.)

WANTED, a good steady Man as RETORT-HOUSE FOREMAN. Must have a good practical knowledge of the working of Generator Furnaces. One who has had some mechanical experience preferred.
The Candidate must have served in a similar capacity, having had the control of a large number of Men.
Age not to be below 30, and not to exceed 40 years.
Applications, in writing only, with recent testimonials, to be addressed to the undersigned.
Wages offered Two guineas per week.

JOS. TIMMINS,
Engineer.

April 21, 1892.

GAS-METERS FOR SALE.

THE Royal Agricultural Hall Company, Limited, Islington, have FOR SALE one 500-LIGHT DRY METER, and one 200-LIGHT DRY METER, which until recently have been used at the Hall, and are in good working order.
Apply to R. VENNER, Secretary, Royal Agricultural Hall Company, Limited, ISLINGTON.

TENDERS FOR GAS COAL.

THE Directors of the Oakengates and St. George's Gas Company invite TENDERS for the supply of 1500 tons of the best screened GAS COAL, delivered free at the Oakengates Station, in such quantities as may be required between June 30, 1892, and June 30, 1893
Tenders, properly endorsed, and accompanied by an Analysis of the Coal offered, to be sent on or before May 14, 1892.
The Directors do not bind themselves to accept the lowest or any tender.

GEO. PARKER,
Manager.

April 23, 1892.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

OIL for the "Wells" or "Lucigen" Lamps.
HARDMAN AND Co., Miles Platting, MANCHESTER.

COZE'S Automatic Apparatus for CHARGING AND DISCHARGING GAS-RETORTS. For Illustrated Advertisement of this System, see p. II., centre of JOURNAL.
Inquiries should be addressed to THE AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED, 86-88A, LEADENHALL STREET, E.C.

DRAWINGS, Tracings, Specifications, Quantities, &c., prepared by an experienced Engineering Draughtsman. Plans of Works made, copied, or enlarged. Blue copies made. Illuminated Addresses in first-class style. Writings of all kinds, Engrossments, &c.
Address J. L. FEATHERSTONE, 173, Fentiman Road, LONDON, S.W.

FRIEDRICH LUX, Ludwigshafen am Rhein; and at No. 142, Great Portland Street, London, W.
LUX'S Gas Regulators for every consumption.
LUX'S single-stem Pressure-Gauges.
LUX'S Regulator for Gas-Engines.
LUX'S Gas-Balance.
LUX'S new Gas Regulator for Inverted Lamps and other Apparatus for Gas Lighting, &c.

TO INVENTORS.

A NEW Idea Wanted in Small GAS-STOVES for Boiling Kettles. Must be without smell.
Apply to No. 2091, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Sharon Chemical Company, Ltd., Derby, are buyers of AMMONIACAL LIQUOR and Sellers of TAR and SULPHURIC ACID. They frequently buy, sell, hire, or let Railway TANK-WAGONS. Correspondence invited from persons interested.

GAS APPLIANCES EXHIBITION.

THE Gas Department of the Penrith Local Board purpose holding an EXHIBITION OF APPLIANCES FOR THE UTILIZATION OF GAS, on June 1 and three following days.
Application for space may be made to the undersigned.
Space reserved for Cooking-Stoves and Gas-Fires is already taken up.

E. SHAUL.

Gas-Works, Penrith.

LEIGH LOCAL BOARD.

FOR SALE (cheap)—One 20,000 cubic feet per hour GAS EXHAUSTER and STATION METER, both complete with Valves and Connections.
Particulars from

A. T. FLETCHER,
Engineer and Manager.

Gas-Works, Leigh, Lancs.,
April 1, 1892.

RICHMOND (SURREY) GAS COMPANY.

FOR SALE—The Directors have for disposal a Cast-Iron ANNULAR CONDENSER suitable for a make up to 750,000 feet per day, which has been taken down to make room for extensions. The Condenser is complete with 12-inch Connections and Valves, and will be put on Rail for the sum of £150.
Further particulars will be supplied by the undersigned.

THOMAS MAY,
Engineer and Manager.

April 20, 1892.

BRENTWOOD GAS AND COKE COMPANY.

TENDERS are invited for repairs to a GASHOLDER.
Full particulars may be obtained on application to Mr. C. A. Fielder, Secretary, Brentwood, Essex.
Sealed tenders, addressed to the Chairman of the Company, to be sent in on or before May 2.

CITY OF BRUSSELS GAS FACTORY.

TAR.

THE Communal Administration of Brussels will, until the 24th of May, receive OFFERS for the taking up of 5400 tons of TAR, to be removed between the 1st of July, 1892, and the 30th of June, 1893.
For particulars apply to M. LE DIRECTEUR DU SERVICE DU GAZ, 8A, Rue du Chêne, BRUSSELS.

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Waterside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained, free of charge, at their Offices, 80, CHEAPSIDE, E.C.

TAMWORTH GASLIGHT AND COKE COMPANY.

TO GASHOLDER MAKERS.

THE Directors of this Company are prepared to receive TENDERS for the re-plating of one of their GASHOLDERS, 50 ft. 9 in. diameter and 22 feet deep.

Specifications may be seen at the Secretary's Office, 23, George Street, Tamworth, on and after the 20th inst.

The Directors do not bind themselves to accept the lowest or any tender.

SURPLUS PLANT FOR SALE.

THE Directors are prepared to dispose of an excellent 5-horse power STEAM-ENGINE by May and Mountain, of Birmingham; also a GASHOLDER, 29 ft. 9 in. in diameter and 14 feet deep, with Columns, Weights, &c.

The above can be seen at the Works; and offers for he same may be addressed to the Secretary, 23, George Street, Tamworth.

Gas-Works, Tamworth,
April 11, 1892.

PRESTON GAS COMPANY.

THE Directors of the Preston Gas Company invite TENDERS for the supply of CANNEL and GAS COAL for One, Three, or Five years, from the 1st of July next.

For particulars apply to the undersigned.

Sealed tenders, endorsed "Tender for Coal, &c.," and addressed to the Chairman of the Company, must be received not later than Wednesday, the 4th of May, 1892.

HENRY GREEN,
Engineer.

Preston, April 12, 1892.

ACCRINGTON GAS AND WATER WORKS COMPANY.

TENDERS FOR TAR AND AMMONIACAL LIQUOR.

THE Directors invite Tenders for the purchase of the TAR and AMMONIACAL LIQUOR which may be produced at their Accrington and Great Harwood Works during a period of One year, commencing on the 1st of July next.

The quantity will be about 1900 tons of Tar and 3000 tons of Liquor (10-oz.).

Tenders, addressed to the Chairman, Offices of the Company, St. James's Street, Accrington, must be in my hands not later than Wednesday, the 8th of June.

By order,
CHAS. HARRISON,
Secretary and Manager.

CITY OF BIRMINGHAM.

TENDERS FOR AMMONIACAL LIQUOR.

THE Gas Committee invite Tenders for the purchase of the AMMONIACAL LIQUOR produced at their Works during a period of Ten years, beginning on July 1, 1893.

The quantity produced in the year ended March 31, 1891, was 18,682,000 gallons of 10-oz. Liquor.

Provision may be made for dealing with the Liquor either in Works now erected on Land belonging to the Corporation, or on Land to be let for the erection of new Works.

Copies of the conditions on which tenders are invited may be obtained on application to

EDWIN SMITH,
Secretary.

City Gas Offices, Council House,
Birmingham.

BUXTON LOCAL BOARD.

TENDERS FOR CANNEL.

THE Gas Committee invite Tenders for the supply of good CANNEL, for One or more years, at the rate of about 3800 tons per annum, to be delivered at their Siding (on the Midland Railway) in Ashwood Dale, Buxton.

Tenders, endorsed "Tender for Cannel," addressed to the Chairman of the Gas Committee, to be delivered at the Gas Office, Town Hall, not later than Noon on the 22nd day of May.

Forms of Tender and other Particulars may be obtained of Mr. G. Smedley, Engineer, Gas Office, Bridge Street, Buxton.

The Board do not bind themselves to accept the lowest or any tender.

By order,
JOSIAH TAYLOR,
Clerk.

BUXTON LOCAL BOARD.

TENDERS FOR GAS COAL.

THE Gas Committee invite Tenders for the supply of good GAS COAL, for One or more years, at the rate of about 1500 tons per annum, to be delivered at their Siding (on the Midland Railway) in Ashwood Dale, Buxton.

Tenders, endorsed "Tender for Gas Coal," addressed to the Chairman of the Gas Committee, to be delivered at the Gas Office, Town Hall, not later than Noon on the 22nd day of May.

Forms of Tender and other Particulars may be obtained of Mr. G. Smedley, Engineer, Gas Office, Bridge Street, Buxton.

The Board do not bind themselves to accept the lowest or any tender.

By order,
JOSIAH TAYLOR,
Clerk.

BUXTON LOCAL BOARD.

TENDERS FOR TAR AND LIQUOR.

THE Buxton Local Board invite TENDERS for the purchase of the surplus TAR and LIQUOR produced at their Works in Ashwood Dale, for One, Two, or Three years, commencing from the 30th of June next.

Further Particulars and Forms of Tender to be obtained of Mr. G. Smedley, Gas Office, Buxton.

Tenders, endorsed "Tender for Tar and Liquor," to be addressed to the Chairman of the Gas Committee, and delivered not later than Twelve Noon on the 16th of May.

The Board do not bind themselves to accept the highest or any tender.

By order,
JOSIAH TAYLOR,
Clerk.

GEORGETOWN (BRITISH GUIANA) GAS COMPANY, LIMITED.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Shareholders of the above Company will be held at the Offices of the Company, 30, Gracechurch Street, in the City of London, on Tuesday, the 17th day of May next, at Three o'clock in the Afternoon precisely, to receive the Directors' Report and the Accounts of the Company for the Half Year ended the 31st day of December last, to declare a Dividend, to elect Directors in the place of those retiring by rotation, to elect an Auditor, to settle the remuneration of the Secretary, and to transact the General Business of the Company.

The Transfer Books will be closed from the 4th to the 17th of May next, both inclusive.

By order of the Board,
SAMUEL WOOD,
Secretary.

Offices: 30, Gracechurch Street,
London, April 19, 1892.

TENDERS FOR COAL.

THE Scarborough Gas Company invite TENDERS for the supply of about 18,000 tons of best screened GAS COAL or COBBLES per annum for One or Two years from the 1st day of July next.

Tenders, endorsed "Tender for Coal," must be delivered at the Company's Offices, not later than Ten o'clock a.m. on Monday, the 9th of May next.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
WILLIAM J. MOON,
Secretary and Manager.

Scarborough, April 23, 1892.

TO BUILDERS AND CONTRACTORS, ETC.

THE Gas and Water Committee of the Ashton-in-Makerfield (Lancs.) Local Board invite TENDERS as follows:—

(a.) For Excavating for and building a GASHOLDER TANK, 72 feet diameter, and 24 feet deep.

(b.) For a TELESCOPIC GASHOLDER in two Lifts, the lower Lift 70 feet diameter and 24 feet deep. The upper Lift 68 feet diameter, and 24 feet deep, with Wrought-Iron Lattice Columns and Girders, Guide Rails, Inlet and Outlet Pipes, and Valves complete.

Drawing and Specification of the Tank may be seen on application to the undersigned.

Drawings and Specification to accompany tender for Gasholder.

Particulars may be obtained on application to the undersigned.

Tenders, endorsed "Gasholder Tank" or "Gasholder," to be delivered to me on or before Monday, the 9th of May next ensuing.

The Committee do not bind themselves to accept the lowest or any tender.

JAS. HILL,
Clerk, &c.

April, 1892.

GLASGOW CORPORATION GAS.

RESIDUAL PRODUCTS FOR SALE, AND RESIDUAL PRODUCT WORKS TO LET.

THE Glasgow Corporation Gas Commissioners are prepared to receive TENDERS for (1) The purchase of the TAR and AMMONIACAL LIQUOR produced at their Temple Farm and Old Kilpatrick Gas-Works for the period from the 1st of June, 1892, to the 31st of May, 1893; (2) the purchase of the TAR and AMMONIACAL LIQUOR produced at their Pollokshaws Gas-Works for the same period; and (3) a LEASE of the RESIDUAL PRODUCT WORKS, in West Street, Glasgow, recently acquired by the Corporation from the Glasgow Alum and Ammonia Company, Limited, for the period from the 15th of May, 1892, to the 11th of November, 1893.

Forms of Tender for the Residual Products on which offers must be made, and Cards of Admission to inspect, and all other particulars with reference to the Residual Product Works, may be had on application to the Manager at the Gas Office, 45, John Street, Glasgow; and offers, endorsed "Tender for Residual Products," or "Tender for Residual Product Works," will be received by the Subscriber on or before Tuesday, the 3rd of May, 1892.

The Commissioners do not bind themselves to accept the highest or any tender.

J. D. MARWICK,
Town Clerk.

City Chambers, George Square,
Glasgow, April 20, 1892.

ILFORD GAS COMPANY.

BY ORDER OF THE DIRECTORS.

MR. ASHMOLE will sell by Auction, at the Angel Hotel, Ilford, on Thursday, the 19th of May, 1892, at Six for Seven o'clock p.m., 400 "B" SHARES of the nominal value of £5 per Share, in the Ilford Gaslight and Coke Company, Limited.

For particulars, apply to the SECRETARY or the AUCTIONEER.

C. & W. WALKER'S

GASHOLDERS; PURIFIERS; PURIFYING MACHINES;

CO_2 AND TAR-EXTRACTING WASHERS; SCRUBBERS;

SULPHATE & SULPHUR PLANT;

PATENT SELF-SEALING RETORT MOUTHPIECES;

LIFTING APPARATUS; CENTRE AND FOUR-WAY VALVES;

SOLE MANUFACTURERS OF WECK'S PATENT CENTRE-VALVE;

PATENT TAR PLANT; CONDENSERS;

SLIDE VALVES; TAR BURNERS; &C., &C.

WOOD SIEVES.

ADDRESSES:

MIDLAND IRON-WORKS, DONNINGTON, NEAR NEWPORT, SHROPSHIRE;

10, Finsbury Square, London.

"FORTRESS DONNINGTON." "FORTRESS LONDON."—Telegraphic.

MESSRS. Wheatley and Mackenzie beg to say that they have acquired the business of the late W. H. BENNETT, Esq., and that having a special experience in matters connected with Gas, Water, and Sanitary Improvement, will continue to give the same assistance to Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, or LETTERS PATENT.

Patents completed or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to WHEATLEY AND MACKENZIE, 40, Chancery Lane, LONDON, W.C.

ENFIELD GAS COMPANY.

SALE OF 400 £10 SHARES BY ORDER OF THE DIRECTORS.

MR. ALFRED RICHARDS will sell by Auction at the Mart, E.C., on Monday, the 9th of May, at Two o'clock precisely, in lots, 400 £10 SHARES in the Enfield Gas Company.

The last Dividend on the same class of Shares was at the rate of 7 per cent.

Particulars of J. PURDEY, Esq., Secretary to the Company, ENFIELD; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.; and TOTTENHAM.

BY ORDER OF THE EXECUTORS OF R. H. SWAINE, ESQ., DECEASED.

CROYDON GAS COMPANY.

Sale of 886 Shares in the Croydon Commercial Gas and Coke Company, producing Dividends at the rate of 14 and 11 per cent. per annum respectively.

THURGOOD AND MARTIN have received instructions TO SELL BY AUCTION, at the Greyhound Hotel, High Street, Croydon, on Wednesday, the 27th of April, 1892, at Six o'clock precisely, in 60 lots, 285 SHARES (£5 fully paid), producing Dividends at the rate of 14 per cent. per annum, and 601 SHARES (£5 fully paid), producing Dividends at the rate of 11 per cent. per annum; all in the Capital of the Croydon Commercial Gas and Coke Company.

An excellent opportunity for the secure Investment of large or small amounts; the Dividends being well secured against fluctuation by ample Reserve and Insurance Funds.

Particulars and Conditions of Sale may be had of Messrs. STEPHENS AND STEPHENS, Solicitors, 29, Essex Street, STRAND, W.C.; at the place of SALE; and of the AUCTIONEERS, 27, CHANCERY LANE, W.C.

Price: 10s. *per* 100; £1 2s. 6d. *for* 250; £2 *for* 500; £3 15s. *per* 1000. *Specimen copy (by post)*, 4d.

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Illuminating Power . . . 37·56 Candles.

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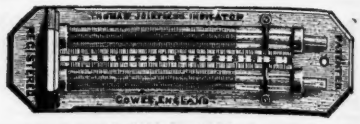

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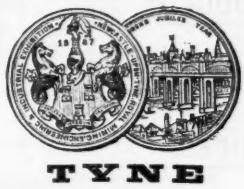

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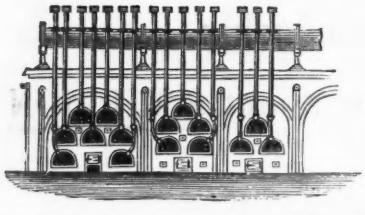

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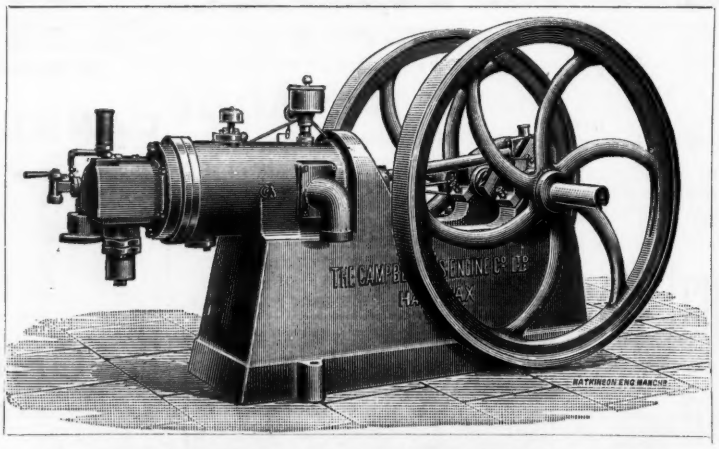

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This Meter has a simple Automatic arrangement fitted, whereby, upon the insertion of a shilling, a supply of gas can be obtained, and which is cut off on the quantity paid for being consumed. The Meter gives warning when the quantity is nearly exhausted, so that another shilling may be inserted. There is, however, no occasion to wait until this happens, as a second shilling can be inserted after two-pennyworth of the first shilling has been consumed.

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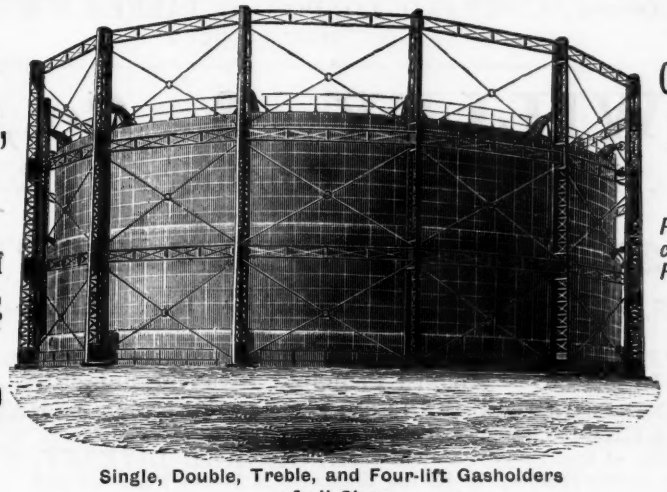

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Analysis: 12,600 feet of 19-candle gas per ton.
Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.
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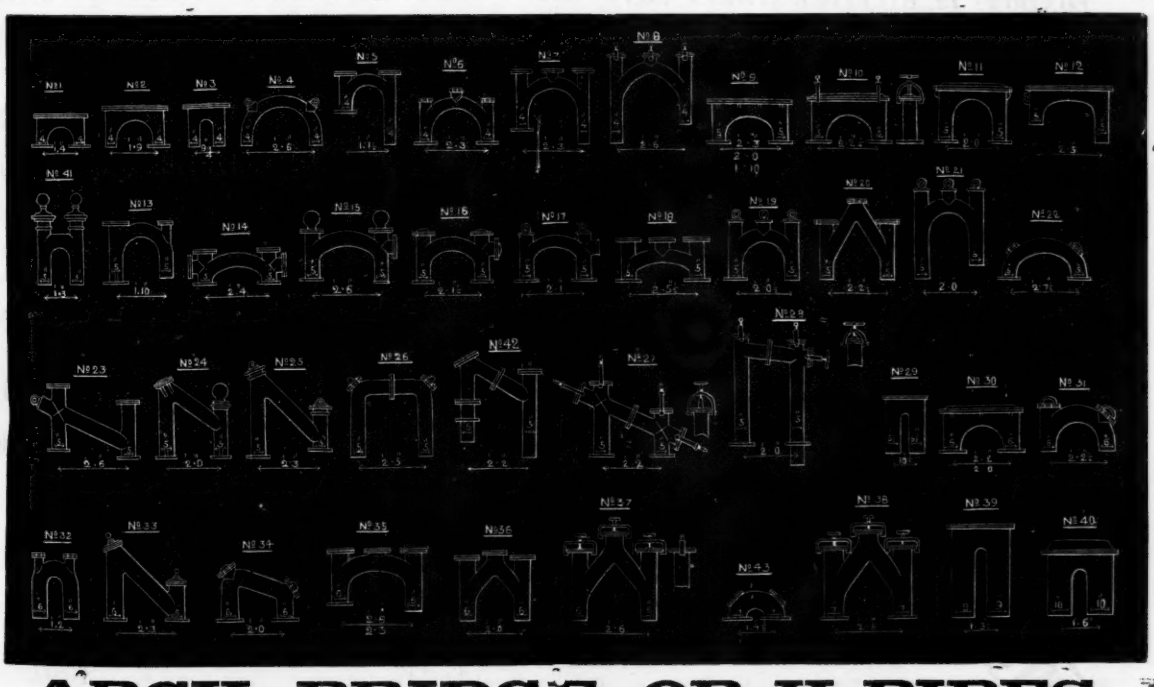

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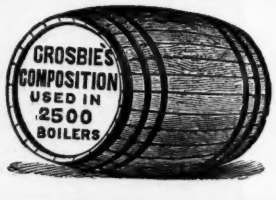

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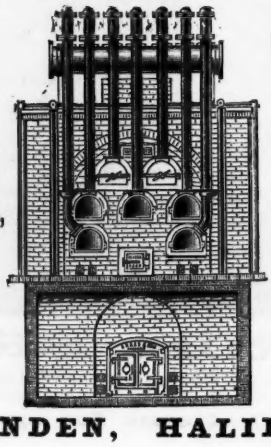

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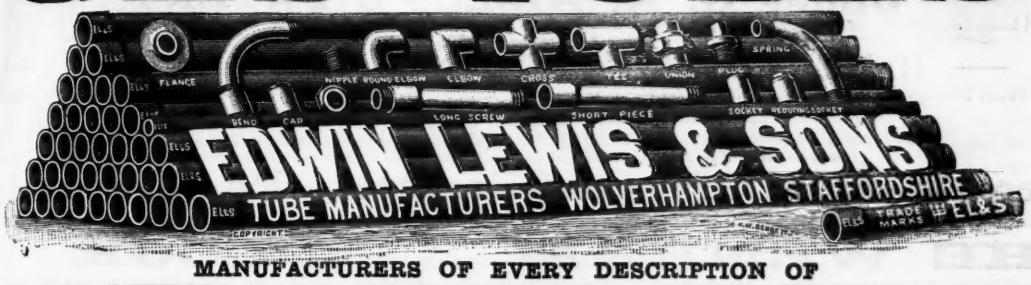

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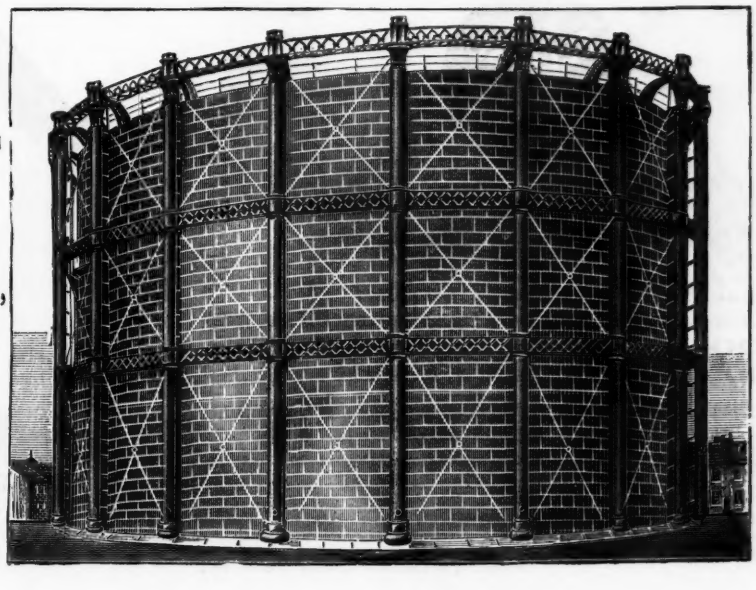

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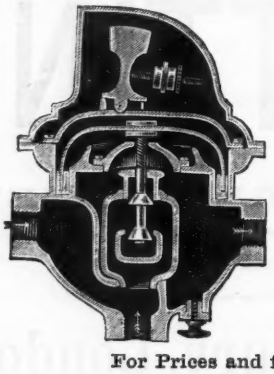

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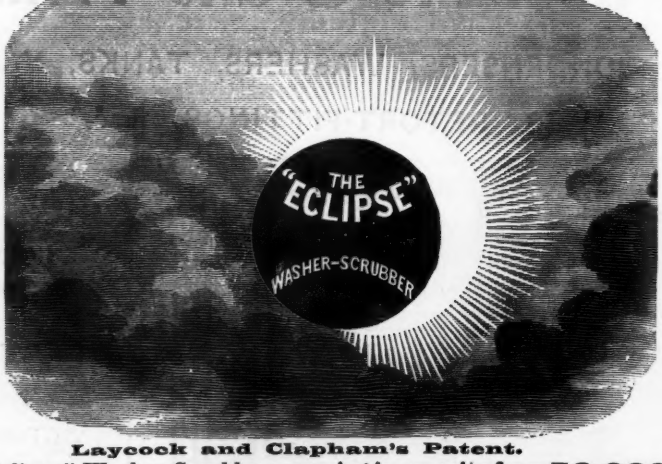

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